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ABSTRACT

Reported was a project studying the school performance of children who had survived laboratory confirmed Haemophilus influenza meningitis prior to 4 years of age without observable sequelae and who were enrolled in regular primary grades. Thirty-nine index children were matched with controls by age, sex, socioeconomic level, and classroom membership, and 19 index cases were matched with primary controls on the basis of hospitalization at same age with non-meningitic illness, sex and race. Post-Haemophilus influenza children were found to perform significantly lower than controls on measures of school achievement, group IQ, and teacher rating. Recommended was a preschool intervention program for post-meningitic children which would offer special guidance in school readiness activities which increase instructional receptivity, student image, and motor coordination. (Author/GW)

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FINAL REPORT

Project No. 0-D-063
Grant No. OEG-4-71-0019

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THE SCHOOL PERFORMANCE OF POST-H. INFLUENZA MENINGITIC CHILDREN

July 1972

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

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National Center for Educational Research and Development
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THE SCHOOL PERFORMANCE OF POST-H. INFLUENZA MENINGITIC CHILDREN

Author's Abstract

Purpose:

In continuing a step-wise research program examining relationships between school adjustment and prolonged high fevers during early childhood, a third project was carried out to study the school performance of post-H. flu meningitic children.

Methodology:

Following recommendations of previous studies, two research centers identified children from hospital records who had survived laboratory confirmed H. flu meningitis prior to 4 years of age without observable sequelae and who were currently enrolled in regular primary grades. In one center, 39 index children were matched with controls by age, sex, socio-economic level, and classroom membership. In the other center, 19 index cases were matched with primary controls on basis of hospitalization at same age with non-meningitic illness, sex, and race. Secondary controls for index and primary controls were matched by age, sex, race, and classroom membership. Standardized test results and teacher appraisal material gathered on all subjects were subjected to t-tests and multiple discriminate analyses.

Results:

Post-H. flu children and controls differed significantly on measures of school achievement, group IQ, and teacher rating.

Conclusions:

These findings confirm previous findings that post-meningitic children apparently have long-term subtle sequelae which impair school success. They underscore the need for preschool intervention for post-meningitic children.

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SUMMARY

Children seen in mental health, school guidance, and child development clinics are frequently reported to have suffered from some ill-defined high fever during early infancy. So frequent are these reports that a multi-disciplinary group involving educators, psychiatrists, pediatricians, and others elected to study relationships between prolonged high fevers of early infancy and subsequent school success. Acute bacterial meningitis afforded a workable criterion since it induces prolonged high fevers and is confirmable by standard laboratory procedure.

A research program was designed, entailing five stand-alone step-wise projects. The first study compared the intelligence quotient of survivors of H. flu meningitis with their nearest age sib. Results of this project showed dramatically significant differences in IQ's of H. flu survivors and their nearest age sibs. The second project compared the school adjustment of survivors of acute bacterial meningitis with a control group matched on the basis of age, sex, socio-economic position, and classroom membership. To conduct the second project, a consortium of five medical schools and five public school systems was organized. Specialists in psychiatry, pediatrics, neurology, epidemiology, social work, psychology, education, and physical education collaborated on the study and gathered data on a wide parameter of measures. Here again, significant differences were observed between post-meningitic children and their matched controls, pointing to deficits in instructional receptivity, student image, and motor coordination. A third project was formulated on the basis of results and recommendations of the second project.

This report details the third project in the step-wise progression of stand-alone projects. It was designed to study the school performance of post-Haemophilus influenza survivors.

Scope of the Study

Viewed as the third project of a research program, this study had several dimensions clearly imposed. First, the sample of post-meningitic children was to be broadened both geographically and numerically. Post-meningitic children were identified and selected from two different research locations, one in Dallas and the other New Orleans. The sample size was also expanded to fifty post-meningitic subjects.

Second, samples in both Dallas and New Orleans were restricted to children who had survived H. influenza meningitis rather than all three types of acute bacterial meningitis. Refining the samples to one type of meningitis would contribute additional significance for epidemiologists and pediatricians, while more importantly, strengthening the imperative for immunization methods to prevent Haemophilus influenza meningitis.

Third, an additional control measure was introduced by matching H. influenza survivors with children who had been hospitalized at the same age with non-meningitic illnesses. The design intent was to rule out the trauma and psychological sequelae often accompanying hospitalization.

Objectives

This project established three goals as base lines upon which to develop the study:

1) To examine and clarify the educational performance of primary grade level children who have survived H. flu meningitis without observable sequelae.

2) To formulate strategies for intensive prospective studies of post-H. flu meningitic children if warranted.

3) To strengthen and sustain a research consortium of five metropolitan school districts and their respective medical colleges.

Methods

In two centers, standard medical records were gleaned to identify children who had survived laboratory confirmed H. flu meningitis prior to the age of four years. Setting the cut-off age of illness at four allowed a two year gap prior to age of school entrance, permitting ample time for transient sequelae to disappear. The index sample selected for this study, therefore, could be judged as sequelae free, completely competent, and enrolled in the regular school program.

Criteria for control populations were different in the two centers, and in effect, two separate studies were carried out. Dallas controls were matched with H. flu survivors on the basis of age, sex, socio-economic position, and classroom membership. Achievement tests, intelligence tests, and other educational data were gathered from existing school records and additional material was supplied by classroom teachers. Comparisons, therefore, could be made on the same variables for matched pairs.

New Orleans controls were matched with H. flu survivors on the basis of having been hospitalized at the same age but for non-meningitic illness. The New Orleans research group selected survivors of shagella and salmonella as primary control subjects, while recognizing that prolonged high fevers often accompany shagella and salmonella. Primary controls then were matched with H. flu survivors on the basis of sex, race, and age at hospitalization. A set of secondary controls was then selected from classrooms of index and primary controls and matched on the basis of age, sex, and classroom membership. Criterion measures of school performance including achievement and teacher ratings could then be controlled statistically.

Results

In Dallas, data were available on 39 pairs of subjects matched by age, sex, socio-economic index and classroom membership. Two-tailed t-tests were carried out and differences between index post-H. flu meningitic children and matched classroom controls were striking indeed. On measures of school readiness, school achievement, group administered IQ, and teacher ratings, statistically significant differences were found. These results corroborated findings of other studies.

In New Orleans, complete data were available on 19 post-H. flu meningitic index children, and their primary non-meningitic hospitalized controls, as well as secondary controls for both groups. These data were analyzed by t-tests and by multiple regression techniques. In predicting from age, sex, race, and various combinations of sample groups, the most significant results are obtained by comparing hospitalized children with their non-hospitalized classroom controls. In multiple discriminant analysis, three functions were derived to discriminate among the four sample groups. Almost all variance was contributed by post-H. flu meningitic and non-meningitic hospitalized children against classmate controls.

Significance of the Findings

The findings of this project substantiate findings of the prior two projects in this total research program on the post-meningitic child. The post-meningitic child apparently has more difficulties in total school performance than his matched control and these differences are manifest in the teacher's appraisal of the child as well as in his academic and intellectual performance.

Results of the program demonstrate that in three different research centers groups of post-meningitic children were found to differ from their matched controls. In these centers, the alignment of research resources and personnel differed, but the findings concur.

Implications

This project confirms previous findings and professional literature indicating that the post-meningitic child needs some pre-school intervention if he is to successfully compete with his non-meningitic classmates. Handicaps related to meningitic illness are reflected quite soon in school performance, and in these cases, persisted through the third grade of school.

What is needed appears to be a systematic broadly based pre-school intervention program. Post-meningitic children need special guidance in the school readiness activities and special attention to activities which increase instructional receptivity, student image, and motor coordination.

Recommendations

Sufficient evidence has been accumulated to warrant an extensive prospective study, providing systematic pre-school intervention for post-meningitic children. Intervention may be provided in several research centers to test the efficacy of various approaches. With rigorous and consistent monitoring, predictive measures could be formulated, implemented, and subsequently validated by comparing post-meningitic and control children.

CHAPTER I

INTRODUCTION

This report describes the second study in a research program involving numerous professional disciplines in the public schools and the medical colleges of five active child research communities: Atlanta, Dallas, Memphis, Nashville, and New Orleans. The public schools in each of these cities, together with their respective local medical colleges of Emory University, University of Texas, University of Tennessee, Vanderbilt University, and Tulane University, share an interest in an expansion of applied research on the problems of handicapped children.

In selecting one area of common concern, these five research communities charted a course which included this exploratory study as preparatory to a subsequent prospective research design. The first study exploring the school adjustment of post-meningitic children was conducted at Vanderbilt University where the program was conceived and initiated. Outcomes of the exploratory phase and recommendations for expanded research led to the second phase of the program.

The second phase, examining the School Performance of Post-Haemophilus Influenza Meningitic Children, is the topic of this report. This introductory chapter provides a background for the research project, briefly states the scope and objectives of the study, and indicates the significance of the undertaking.

Background for the Project

School pupil personnel services and mental health clinics are well aware that a disproportionately large number of children with school and/or mental health problems share a common history of school difficulties during primary grades. Of even more arresting interest is the frequency with which those who failed first grade are reported to have a history of prolonged high fevers during childhood. Prolonged high fever during early childhood may induce organic behavior problems, and organic behavior problems do contribute to failure in the first year of school. Therefore, study of the relationships between first grade failure and sequelae from high fevers is of primary educational import. These possible relationships have been subjectively assumed but lack the foundation of firm data.

Many childhood diseases could induce organic behavior problems, but acute bacterial meningitis is one of the few which can be surely diagnosed by laboratory procedures. With bacterial meningitis as the criterion, investigators could compare one homogenous group of known post-meningitic children to another matched group of known non-post-meningitic children while examining causal relationships, predictive measures, and ameliorative interventions.

For almost ten years, the principal investigator and colleagues have been conducting research to screen out kindergarten and beginning first grade students who will not make an adequate adjustment in school. These children with potential can be referred to specialists for diagnosis, remedial measures, and special educational guidance, thereby preventing or ameliorating their school problems. This protracted research has led to the development of the First Grade Screening Test, (Pate and Webb, 1966), which has undergone national standardization with more than 10,000 kindergarten and first grade students.

Field research, pilot studies, and the standardization study repeatedly returned the investigators to the persistent realization that some children are simply not able to meet the social and academic expectations of regular schools. Some of these children may be intellectually retarded; some may have organic behavior problems; and some are emotionally disturbed; but most, probably have mixtures of all these handicaps. Although promising school practices augur a more satisfactory school environment for those children, clearly, something needs to be done to help them before they are faced with the expectations of the classroom procedure.

With this in mind, a variety of investigatory systems were explored. The lines of greatest educational relevance, scientific feasibility, general benefit to children merged at the school adjustment of post-meningitic children. To deal adequately with the focal problem, a consortium of five school systems and five medical centers was formed: Atlanta City Schools and Emory University Medical School; Dallas City Schools and University of Texas Medical School; Memphis City Schools and University of Tennessee Medical School; Metro-Nashville Schools and Vanderbilt University Medical School; and New Orleans City Schools and Tulane University Medical School. From these resources, educators, special educators, psychologists, social workers, child psychiatrists, neurologists, pediatricians, epidemiologists, and public health specialists have participated in designing and conducting a research program with several independent phases.

The consortium elected to study the school-related sequelae of a high prevalence, clearly diagnosable, infectious disease. Acute bacterial meningitis, a very serious cause of mortality and permanent damage in children, met these requirements. An exploratory study was designed and conducted in the Vanderbilt University research community, leading to the second stand-alone project, which is the topic of this report, the school performance of post-H. *flu* meningitic children. At this point, however, some clarification of acute bacterial meningitis and of Haemophilus *influenza* meningitis is warranted.

The School Adjustment of Post-Meningitic Children

Acute bacterial meningitis. Acute bacterial meningitis is an inflammation of the meninges (membranes covering the brain and spinal cord). Pus cells and bacteria in the cerebrospinal fluid provide positive clues to diagnosis. Three strains of bacteria are responsible for most cases: 1) meningococcus (sometimes called epidemic meningitis), 2) pneumococcus (a common cause of pneumonia), and 3) the influenza baccillus (erroneously named when it was thought to cause epidemic influenza).

Meningitis tends to occur with the greatest incidence in infants and young children, with the highest mortality rate and serious brain damage in the youngest ages. Modern therapy, including antibiotics and intravenous fluids, if started within the first day or so of illness, markedly reduces the seriousness of the disease. There are exceptions, of course, but patients may be recovered after about ten to fourteen days.

The three bacterial species, which are the usual etiological agents, may be associated with less serious or minor respiratory illness in some children. The reason is unknown why some children get septicemia and meningitis while others seem to handle the infection without serious effects. H. *influenza* is the leading cause of acute meningitis in children under 3 years of age while the others lead in older children. Meningococcus tends to occur in large epidemics which occur about every ten years, but there are a few cases every year. Pneumococcus affects all ages every year.

Clinical features of meningitis, which is characterized by high fever, headaches, stiff neck and vomiting, are similar for these strains of bacteria. Therefore, accurate diagnosis requires examination of cerebrospinal fluid, which means medical attention (usually hospitalization) at the time of the illness. Early diagnosis and modern therapy have made a striking improvement, in the prognosis. Whereas in the past, acute meningitis was usually fatal, for the past decade the mortality has dropped to 10-15% (Haggerty & Ziai, 1964).

The exact number of children in the United States who have acute meningitis each year is not definitely known. However, existing statistics estimate that about 20,000 children, under age 14, have the disease yearly (Haggerty & Ziai, 1964). Since accurate diagnosis requires a spinal puncture and bacteriological laboratory procedures, undoubtedly there are many cases that are not properly diagnosed and therefore not reported. Of the estimated 18,000 yearly survivors, many will have some degree of residual brain damage. Major neurologic sequelae are greatest among infants. An unknown number may have minimal residua. The nature of this mild damage and the extent to which it may influence the total effectiveness of the child as he develops are not fully understood.

The sequelae of acute bacterial meningitis. Literature on the residua from meningitis is rich but somewhat disquieting. A large proportion of the references deal primarily with the therapeutic possibilities for the acute episodes. This body of literature for the years 1945 through 1968 includes 134 entries which have been annotated and published (Sell, et.al., 1969) and reviewed by Webb et. al., (1968).

The notion of mild brain damage has attracted investigators from many disciplines, who have addressed themselves to educational aspects of what has been termed "minimal brain dysfunction," "Strauss syndrome," "learning disability," or "hyperkinetic syndrome." Clements (1966), Dunn (1965),and others have discussed these concepts, their terminology, and the question of their unitariness and usefulness. A reasonable conclusion from such studies is that future investigations should move from general to specific considerations of such problems.

A review of studies focusing on sequelae of diagnosed acute bacterial meningitis would be pertinent. Hutchinson and Kovacs (1963) reviewed the English literature since 1949 on the long-term sequelae of purulent meningitis. Those studies agree on approximately 18% incidence of serious sequelae (mental retardation, auditory and visual defects, speech problems, seizures, and paralysis), but none reported a search for more subtle disruption of function which could result in school and social adjustment difficulties. Hutchinson and Kovacs also reported on their own study of 122 children treated for acute pyogenic meningitis. Psychiatric, neurological, encepholographic, and psychological evaluations were carried out on 41 children 2.5 to 7.5 years after their acute illnesses. "Children with sequelae tended to have several abnormal test results, the total number with neuropsychiatric and/or psychological sequelae being 11 (26%)." This finding suggests that their group of subjects may have included a sizeable number of children suffering from more subtle sequelae who were not identified in previous studies.

Subsequently, Johnson (1960) reported on the short-term effects of purulent meningitis on the mental development of children. The Vineland Social Maturity Scale was completed retrospectively on each child in order to obtain an estimate of pre-illness developmental status. Intelligence tests (Cattell Infant Intelligence Scale and Stanford-Binet Intelligence Scale) were administered one month post-illness and again three months post-illness. Of 100 cases, 3% were severely impaired physically and mentally, and 6% showed a drop of five or more quotient points from pre-illness to three months post-illness. These results raise some doubt about less serious sequelae in their group of subjects; however, the pre-illness measure of developmental status used was not designed to detect mild variations in function.

Kresky, Buchbinder, and Greenberg (1962) studied neurologic residua after recovery from bacterial meningitis. Tests of intelligence indicated that ability was not impaired, yet the children tended to show clinical test evidence of "brain injury" and perform poorly in school. While 13% of the subjects had serious deficiencies, at least 35% had problems which could be detected --some of which were minor and may even have predated the meningitis.

Dodge and Swartz (1965) included a summary of observed neurologic sequelae in their investigation; the incidence for their 99 patients was 21%. They did not attempt to assess subtle problems.

Galloway (1966) found a similar incidence of serious sequelae (17%) in post-meningitic Scottish children. Again, no search was made for subtle deficiencies.

Summary. Each year, more than 2000 children under 14 years of age die from reported cases of acute bacterial meningitis, while an estimated 18,000 contract the disease but survive the illness. Of this annual toll of 18,000 children who now survive, approximately 18% suffer seriously disabling sequelae. Most studies have not attempted to evaluate the incidence of less apparent, yet critically important, educational aspects of post-meningitic sequelae. Those researchers who did investigate this area have swelled the number to over 25% of post-meningitic children who suffer residual handicaps of greater or lesser severity. Only one study (Hutchinson and Kovacs, 1963) used a variety of tests and observations in addition to general intelligence tests. None of the studies employed a control group.

The generally accepted view that if a child escapes serious obvious sequelae, he is essentially "cured," must be challenged. Restoration to normal functioning may well be more apparent than real. Subtle deficiencies may be indirect, e.g., mild irritability may repel developing friendships yet not be detectable by a neurological examination. Or they may be direct, yet not become apparent until the child's adaptive abilities are placed under stress. For example, a slight impairment of visual-spatial skills in the pre-school child might go unnoticed, yet result in serious reading difficulties in first grade.

Two conclusions are implicit in the above discussion: 1) severity of sequelae ranges along a continuum from very mild to profoundly severe; 2) interdisciplinary study, involving physicians, educators, psychologists, and social workers is necessary to explore and remediate post-meningitic sequelae. Such studies might illuminate the current shadowy picture of perceptual impairment and "organic" behavior in the large, vaguely-defined group of children with learning problems.

Haemophilus influenza meningitis. By far the most common of the acute bacterial meningitic infections, Haemophilus influenza comprises more than half of all cases of laboratory confirmed meningitis. Since it is most common among children during the ages below three years, its effects are particularly devastating. The bibliography in Appendix A presents an annotated bibliography of the literature concerning these sequelae of H. flu meningitis and several indices have been compiled for the convenience of the reader. The topic headings of the annotated bibliography appear in Chart 1. The fact that immunizations

Chart 1

Topic Headings
Listed in the Index of
An Annotated Bibliography of the Sequelae of H. Flu Meningitis

Arthritis
Auditory impairment
Behavior disturbance
Brain damage
Coma
Convulstions
Death
Dementia
Developmental retardation
Dizziness
Emotional problems
Epilepsy
Extremity, defects in
Focal necrosis
Headache
Intelligency impairment
Mental retardation
Mongolism
Motor impairment
Muscle weakness
Neurologic disturbances
Poor concentration
Psychic disturbances
Puberty delayed or precocious
Reflex change
Skin distrubances
Speech impairment
Subdural effusions
Visual impairment
Withdrawal

for meningococcus and pneumococcus meningitis have been developed only adds impetus to the need for research and distribution of immunizing agents for Haemophilus flu meningitis.

Preliminary studies. A first exploratory study was carried out in the Nashville research community. In this pilot study, 25 children who had survived laboratory confirmed acute bacterial meningitis were matched on the basis of age, sex, socio-economic position, and classroom membership with non-post-meningitic classmates. Experimental and matched control subjects were subjected to intensive examinations in blind fashion by pediatricians, neurologists, psychologists, psychiatrists, and social worker interviews. Findings in this study are reported elsewhere (Sell, et.al., 1971).

The results of the pilot study pointed to several clusters of characteristics which uniquely separated the post-meningitic children from the control children. An "instructional receptivity" factor indicated differences in the ability to express one's ideas in spoken words, to predict future events from past experience, to compare objects of different sizes and shapes, and to associate the stimulus word with the correct picture. Another factor, "student image," indicated that post-meningitic children had difficulty in getting along with their peers, that they were less popular and less able to face new situations, that they lacked motivation and self-confidence, and that they were poorly coordinated physically. Other factors interpreted to have a perceptual-motor component were also evident.

These findings led the consortium to recommend a second exploratory study which would broaden the control population. First, the criterion would be restricted to the Haemophilus influenza meningitis rather than all acute bacterial meningitic infections. Second, a control population of children with non-meningitic hospitalizations of equivalent length and severity would be employed.

Scope of the Study

From its incipience this study was designed as a continuation of the research activities of a ten member consortium representing the public schools and medical colleges of five major southern metropolitan areas. The first exploratory study conducted in Nashville had yielded results which indicated the need for additional research with substantial modification of research design. The strategy of this second exploratory study was to implement the recommendations of the first exploratory study prior to launching an intensive prospective model.

Each of the ten member consortium was to advise and monitor the research program but, in the final negotiations, data were to be drawn from two research communities only. In one community, post-H. flu meningitic children enrolled in regular public classes of Dallas, Texas, would be matched on the basis of age, sex, socio-economic position, and classroom membership with non-post-meningitic classmates. In New Orleans, post-H. flu meningitic index children would be matched on the basis of equivalent age at hospitalization with non-meningitic equivalents. Classmate controls for the non-meningitic hospitalized children and for the post-H. flu meningitic index children would be identified as feasible.

In addition, the advantages of multidisciplinary and multi-institutional research was viewed as providing unusual opportunities for novel approaches to broad common issues, for developing postures and experience in regional research design, and to maximize utilization of personnel expertise. This preliminary phasing and cultivating of a joint research posture would be essential for the realization of cooperative prospective implementation.

A third aspect relating to the scope of this project concerns its orientation toward implementation of results. In addition to relying on publication of results in professional journals, the intrinsic design of the overall program reflects an emphasis on readiness for implementation. The five large school systems and five medical colleges have been involved in every phase of the program; the program belongs to ten participating members. At each meeting an exchange of correspondence among these consortium members has placed additional bricks in the foundation for intensive prospective research as warranted by results. The professional interface has also resulted in fringe benefits of research on perceptual handicapped children and additional activity in infectious disease studies.

Objectives of the Project

This second exploratory study established four goals as baselines upon which to design the study:

1. To examine and clarify the educational performance of primary grade level children who have survived H. flu meningitis.

2. To formulate strategies for intensive prospective studies of post-H. flu meningitic children if warranted by the exploratory study.
3. To strengthen and sustain a research consortium of five large urban school districts and medical colleges located in each school district.
4. To expand cooperative research involving educational and medical institutions in several urban centers.

Significance of the Project

This research study, in implementing the recommendations of previous studies by the same consortium, strengthens and invigorates the participating consortium members. The fact that their recommendations were implemented in the conduct of this study is significant in itself. It clearly dramatizes the fact that the current research program on the sequelae of acute bacterial meningitis is not a one step research exercise but rather is a stepwise but independently scheduled research program leading to carefully designed intensive prospective research with experimental intervention carefully monitored.

More importantly, this research relates closely to the whole problem of rehabilitation of children with developmental defects. This project examined a select group of children known to have survived high fevers, examined their school performance and explored pre-school preventive and remedial techniques to mitigate school problems. This indeed is a small and select group of children and inferences based on their performance is at risk at this stage. However, research has cumulated over the years that acute bacterial meningitis including Haemophilus influenza meningitis frequently results in subtle sequelae that impair the survivor's ability to function. Previous work by this consortium has confirmed much of the earlier research. If the current project finds the same deficits on the school performance of post-H. flu meningitic children, although the sample is small, the educational significance will be indeed compelling.

Similarly, the significance in child health and medical research will be immediate. Conclusive evidence that post-H. flu meningitic children have sequelae which interfere with school performance would affect an increasing demand for augmented research into vaccines for Haemophilus influenza and for other preventive measures.

Maintenance and expansion of a large research consortium is not an end to itself --but perhaps the coordination and implementation of this research apparatus demonstrates the fact and potential for collaborative educational significance. Almost 900,000 children are represented in the combined enrollments of these five school systems alone. This, in addition to the dissemination activities and ripple effect already apparent, does speak strongly to the value of regionally based research programs.

CHAPTER II

METHOD

Carrying out the recommendations growing from the exploratory study, the consortium members designed a project to study one type of acute bacterial meningitis more carefully and to tighten control measures. Due to this high prevalence in early childhood and its close relativeness to other on-going research, Haemophilus *influenza* was selected as the bacterial agent. To improve control procedures, two separate studies were designed to be carried out, each in a different community, but both examining the sequelae of H. *flu* meningitis. In one instance, the control population would be matched by age, sex, socio-economic level, and classroom membership with apparently sequelae-free survivors of H. *flu* meningitis. In the second study, post-H. *flu* meningitic survivors with no observable sequelae would be matched with children on the basis of equivalent hospitalizations.

This chapter, therefore, will describe two separate facets of research on the school performance of post-H. *flu* meningitic children; one conducted in Dallas, Texas, to broaden the sample of post-H. *flu* meningitic children; and the second conducted in New Orleans, to introduce a control variable selected on the basis of equivalent hospitalizations.

Data to be Collected

Data on index and control subjects were gathered from examinations of existing medical and school records together with teachers' evaluation forms. To carry out total program design and assure consistency in each stepwise project, forms used in the earlier exploratory study were utilized for data gathering in the second phase study. From the School Adjustment Forms of the earlier study on the school adjustment of post-meningitic children, forms were selected for data gathering in the immediate project. A General Information Form, the Teacher Appraisal Form, and School Record Collation Form were utilized for data collection and are ahown in Appendix B.

Subjects

In this retrospective study, index subjects were selected from existing medical records of children who had experienced laboratory-confirmed Haemophilus influenza meningitis during the first four years of life and who would currently be enrolled in the first three grades of school. Children who incurred severe permanent sequelae, those who were institutionalized, those who were assigned to special education classes, and those with marked handicaps were excluded from the sample for this research study because the project was concerned only with children who were apparently sequelae-free and able to participate in the regular school program. Only proven post-H. flu meningitic children who appeared to be sequelae-free and completely competitive to the extent of performing in regular public school classes were included in the sample. The post-H. flu meningitic samples, therefore, met two requirements:

1. Laboratory-confirmed Haemophilus influenza meningitis occurring at least two years prior to entering school.
2. Currently enrolled in a regular class in the first three grades of school.

As names of potential index subjects were accumulated from medical records in Dallas and in New Orleans, their location in a public school class was ascertained by a search of existing school records. As index children were located, introductory letters, shown in Appendix C. were mailed to principals in each respective school, introducing the project and the research personnel.

In Dallas, 67 possible index cases were located in the medical files. Of these, 46 were located in the public schools, but only 39 fit the criteria for index subjects. Research personnel then visited the classrooms of index subjects and distributed a family information form to be mailed to all the same-sex children enrolled in the index subjects' classrooms. These forms, shown in Appendix C. supplied information on educational and occupational status of the household head which allowed matching index with control subjects on the basis of Hollingshead two-factor scale of socio-economic level. Table 1 displays the age, grade level, sex, and socio-economic level of index and control subjects in the Dallas sample.

In New Orleans, 81 possible index cases were noted from medical records. Of these, 52 could not be located, 10 were ineligible, and 19 were used as index subjects. Index children were to be matched with controls on the basis of equivalent hospitalizations. An investigator searched hospital and school

Table 1

Description of Subjects from Dallas as Matched Pairs by Age, Sex, Socio-economic Level, and Grade Level

	Pair	Age		Sex		Socio-economic		Grade	
	No.	Exp.	Cont.	Exp.	Cont.	Exp.	Cont.	Exp.	Cont.
1.	02	7.3	7.4	M	M	V	V	1	1
2.	03	9.4	9.1	M	M	V	V	2	2
3.	04	7.5	7.3	M	M	V	V	1	1
4.	05	8.11	8.11	M	M	V	V	2	2
5.	06	7.2	7.3	F	F	V	V	1	1
6.	07	8.4	8.2	F	F	V	V	2	2
7.	08	9.7	9.9	F	F	V	V	3	3
8.	09	7.9	7.1	F	F	V	V	1	1
9.	10	9.10	10.1	M	M	IV	V	3	3
10.	11	8.8	8.3	F	F	V	V	2	2
11.	13	9.8	9.10	M	M	V	V	2	2
12.	14	7.10	7.3	M	M	III	III	1	1
13.	16	8.5	8.3	F	F	V	V	2	2
14.	17	7.7	7.8	F	F	V	V	1	1
15.	18	10.1	9.11	F	F	V	V	3	3
16.	19	9.9	9.10	M	M	V	V	3	3
17.	20	7.10	8.0	M	M	V	V	1	1
18.	21	10.0	9.5	F	F	V	V	3	3
19.	22	9.6	9.2	M	M	V	V	3	3
20.	23	9.1	9.2	M	M	V	V	2	2
21.	24	9.6	9.5	F	F	V	V	3	3
22.	25	7.3	7.3	F	F	IV	IV	1	1
23.	26	7.11	7.6	F	F	V	V	1	1
24.	27	8.1	8.0	F	F	V	V	1	1
25.	28	8.9	8.3	M	M	V	V	2	2
26.	29	8.9	8.8	M	M	V	V	2	2
27.	30	8.7	8.1	F	F	V	V	1	1
28.	31	8.8	8.6	M	M	IV	V	2	2
29.	33	9.2	9.9	F	F	IV	III	3	3
30.	36	8.10	8.5	M	M	IV	IV	2	2
31.	37	8.9	8.4	M	M	IV	IV	2	2
32.	38	9.0	8.4	F	F	V	IV	3	3
33.	39	7.8	7.9	M	M	IV	IV	1	1
34.	42	10.2	9.8	M	M	IV	IV	3	3
35.	43	8.4	8.2	M	M	V	V	2	2
36.	44	8.10	8.11	F	F	V	V	2	2
37.	48	9.0	8.6	M	M	V	V	2	2
38.	49	8.8	8.6	F	F	IV	IV	2	2

records to locate index subjects in regular classes, and explanatory notes to principals were distributed. It was decided by the New Orleans research group that control subjects could be selected from children who had been hospitalized for various diarrheal diseases, principally shigella and salmonella. Diarrheal diseases such as shigella and salmonella are seriously debilitating, often with prolonged illness prior to hospitalization and attentuated physical revitalization. High fever is common.

Each of the index cases and hospital controls was assigned to a study group (A through F) on the basis of race and age at hospitalization within the following matrix:

	Age When Hospitalized		
	< 6 months	6 months - 2 years	2 years - 4 years
white	A	B	C
non-white	D	E	F

Pairs within each group were then identified on the proximity of grade level, though, since the selection criterion was not current age, there were understandable ranges between the ages of index and control subjects. Data on the age, sex, and grade level of index and control subjects from the New Orleans study are shown in Table 2.

Also in New Orleans, secondary controls were selected. Teachers of index post-H. flu meningitic children and control hospitalized shigella-salmonella children were requested to complete a Teacher Appraisal for a classmate of the same sex, race, and age (± 12 months) as the respective index and control subjects. The secondary controls, matched by age, sex, race, and classroom membership are shown in Table 2.

Data Collection

Data were collected through completion of a General Information Form, a Teacher Appraisal Form, and collation of standardized test results from permanent school cumulative records. The General Information and Teacher Appraisal Forms were completedin blind fashion where matched pairs were in the same classroom.

In the Dallasstudy where children were in the same classroom, these forms were completed by the teacher for all children and only data on index and control subjects were considered relevant.

In New Orleans, however, index and hospitalized

Table 2

Description of Subjects from New Orleans
by Age, Grade Level, and Sex

		Age				Grade				Sex			
	Pair No.	1 P-H Flu	2 CC/P-H Flu	3 Eq Hosp	4 CC/Eq Hosp	1 P-H Flu	2 CC/P-H Flu	3 Eq Hosp	4 CC/Eq Hosp	1 P-H Flu	2 CC/P-H Flu	3 Eq Hosp	4 CC/Eq Hosp
1.	01	9.2		8.6		4		4		F		F	
2.	04	9.10		10.6	*	1		6	6	M		M	M
3.	05	11.3	*	11.2	*	6	6	4	4	F	F	F	F
4.	06	9.11	*	10.1	*	6	6	6	6	F	F	F	F
5.	07	9.11	*	8.2	*	2	3	3	4	F	F	F	F
6.	08	8.3		8.9	*	1		2	2	M		M	M
7.	09	11.4	*	11.0	*	4	4	6	6	F	F	M	F
8.	11	10.6	*	9.2	*	1	6	2	2	F	F	F	F
9.	13	12.2		11.2	*	6		3	3	M		M	M
10.	14	11.1	*	12.3	*	3	6	6	6	F	F	F	F
11.	15	10.0	*	10.9	*	6	6	6	6	F	F	F	F
12.	17	10.7		10.9	*	3		6	6	F		F	F
13.	18	10.10	*	11.0	*	3	6	5	1	M	M	M	M
14.	20	10.4	*	9.3	*	6	6	6	6	F	F	F	F
15.	21	10.6	*	9.1	*	6	1	3	0	M	M	M	M
16.	22	9.1	*	9.6	*	4	4	2	2	M	M	M	M
17.	23	9.3		10.0	*	3		3	4	M		M	M
18.	24	8.8		8.1	*	4		3	3	M		M	M
19.	25	10.8	*	9.9	*	4	4	4	4	M	M	M	M
	65			7.10	*			1	1			F	F

*Classroom controls were selected on basis of being within six months of the age of their respective control, post-H. flu or equivalent hospitalization.

control subjects (shigella and salmonella) were not necessarily in the same classroom and consequently had no classroom control against which to be measured. Therefore, Teacher Appraisal and General Information Forms gathered on both index and hospitalized control subjects in New Orleans were gathered by requesting teachers to rate that subject on variables presented on the forms. Admittedly, this procedure lacks any type of rater consistency, and reliability can only depend on the vague norming of "what most teachers would see."

In Dallas and in New Orleans, data from cumulative records weretransferred to forms which could later be collated by the principal investigator's office. Complete print-outs of all categorical data are presented in Appendix D.

CHAPTER III

DATA ANALYSES AND FINDINGS

The questions asked of the data were simple: does the school performance of these groups of post-H. flu meningitic children differ from their non-meningitic controls, and if so, in what respect?

As data accumulated it became clear that vast differences existed between the availability of data in Dallas and in New Orleans. Marked organizational and administrative differences between the school systems resulted in variations of standardized tests utilized and in storage and accessibility of school records. A consequence was that rather complete data were available on Dallas subjects while data on New Orleans subjects were extensive but not entirely comparable for index and control subjects. The fact that New Orleans index and control subjects were at different grade levels and that testing procedures had not been consistent over the years also complicated data collection.

For these reasons, it was necessary to handle the Dallas sample and the New Orleans sample as two separate analyses. Each will be discussed in a separate heading below.

Analysis of Data from Dallas

Data were available on thirty-nine pairs of subjects, matched by age, sex, socio-economic index, and classroom membership, as described earlier in this report. Two-tailed "t"-tests were carried out on all variables in the Teacher Appraisal Form, and results for the forty-four variables are displayed in Appendix E.

It is worth noting that the first seven items on the Teacher Appraisal blank assessed the teacher's opinion of background information, parental attitudes, and parental expectations for their children. None of these seven items produced significant differences.

Of the remaining Teacher Appraisal items, thirteen variables with a $p \leq .05$ are shown with their p values in Table 3. Many of these variables are hallmarks of the child typically labeled as "minimally brain damaged" or "perceptually handicapped." Some of the

Table 3

Comparison of Results of Teacher Appraisal Items on Post-Meningitis Subjects and Their Controls in Dallas

Teacher Appraisal Items	P-M Mean	 Stand.Dev.	Control Mean	 Stand.Dev	Probability for T
Poor general coordination	6.71	.96	6.21	.62	.0013
Reads below expected grade level	7.53	.86	7.05	1.01	.0102
Poor acceptance among peer group	6.37	.79	6.05	.32	.0301
Has poor handwriting	7.08	.99	6.32	.74	.0005
Is careless with school work	7.18	.98	6.53	.89	.0005
Academic achievement is very uneven	7.32	.96	6.45	.83	.0001
Manifests little or no originality	7.45	.89	6.68	.96	.0012
Is sluggish and sedentary	6.60	.92	6.24	.63	.0436
Is shy and withdrawn with adults	6.82	.98	6.47	.86	.0383
Is easily angered	6.66	.94	6.26	.69	.0219
Seldom or never contributes voluntarily to work	6.84	1.00	6.42	.83	.0178
Is uneasy during unstructured activity	6.74	.95	6.37	.79	.0271
Is an under-achiever	7.47	.89	6.74	.98	.0001

variables relating to shyness, reticence to participate, and uneasiness in unstructured activities may indicate features of the emotional overlay which may accompany the tenuous adjustment of the post-H. flu meningitic child, as indicated in earlier studies by this consortium.

Standardized achievement test results were also subjected to "t"-test analysis. Since the subjects were enrolled in primary grades, more subjects would have completed first grade examinations than second grade or third grade. Data were collected in the spring as subjects completed their third year of school, and therefore comparison of scores on the Comprehensive Test of Basic Skills used in the third grade level is available on only four pairs of subjects. Results of data analyses for achievement tests are shown in Appendix E. but for convenience are also displayed in Table 4.

Differences between index post-H. flu meningitic children and their matched classroom controls are striking indeed. On measures of school readiness, school achievement, and group administered IQ as assessed by the Metropolitan Readiness Test, the California Achievement Test, and the California Test of Mental Maturity, respectively, statistically significant differences were found between the two groups, corroborating the pilot studies conducted earlier in Nashville.

Analysis of the New Orleans Data

Data were analyzed on four groups of subjects:

(1) index post-H. flu meningitic children;
(2) secondary controls for index children, matched by age, sex, race, and classroom membership;
(3) hospitalized non-post-meningitic children matched with index children on basis of age at hospitalization, sex, and race;
(4) secondary controls for the hospitalized non-meningitic children, matched by age, sex, race, and classroom membership.

Sampling procedures are described in an earlier section.

A "t"-test was carried out to probe for differences between index post-H. flu meningitic children and their primary hospitalized controls. For this phase of the analysis, data were available on nineteen pairs of subjects and results are shown in Appendix F. These variables showed $p \leq .05$. These variables included

Table 4

Comparison of Achievement Test Data for Post-Meningitis and Matched Control Subjects in Dallas

Achievement Tests	P-M		Control		Pro
	Mean	Stand.Dev.	Mean	Stand.Dev.	for
Metropolitan Readiness Test					
Word meaning	7.17	2.78	8.10	2.92	.067
Listening	9.76	3.08	10.69	2.62	.189
Matching	6.62	4.36	8.10	3.81	.066
Alphabet	9.31	5.86	11.38	5.27	.018
Numbers	11.03	6.20	12.24	5.54	.250
Copying	4.07	2.92	5.83	3.57	.029
Total	48.20	21.12	56.69	19.29	.011
California Achievement Test					
Reading vocabulary	16.82	6.51	19.29	7.27	.041
Reading comprehension	17.29	5.72	17.88	7.20	.502
Total reading	17.00	6.55	19.06	7.17	.042
Arithmetic reasoning	15.82	5.92	18.18	5.34	.014
Arithmetic fundamentals	15.88	8.19	17.35	6.64	.320
Total arithmetic	15.82	6.75	17.35	5.64	.095
Mechanical English	16.59	6.98	19.70	6.13	.028
Spelling	14.47	12.06	18.47	10.76	.067
Total language	17.82	8.33	19.70	6.66	.089
Average grade	16.76	6.90	18.65	6.16	.013
California Test of Mental Maturity					
Logical reasoning	18.95	6.63	23.74	5.74	.002
Number reasoning	10.63	2.71	13.47	3.08	.003
Verbal concepts	13.16	3.20	13.53	4.54	.687
Memory	5.84	3.53	7.63	3.56	.057
Language/IQ	78.68	14.91	85.58	12.65	.024
Non-language/IQ	76.58	17.67	92.10	12.84	.001
Total/IQ	76.68	15.21	87.68	13.22	.001
Comp. Test of Basic Skills					
Reading total	17.75	3.59	28.50	4.44	.006
Language total	18.35	5.44	31.75	9.18	.058
Arithmetic total	19.35	6.65	30.75	3.49	.104
Battery total	18.25	4.11	30.00	2.49	.024
Study skills	17.75	7.23	27.50	11.56	.184

reading below an expected grade level, "has frequent sleepy spells of inattention or staring into space," and "complains of frequent headaches." Additional information is provided by examining probability of F ratios in Appendix F. It will be noted that many variables show an extremely high variability in teacher rating which may make suspect these analyses attempting to compare the ratings of one teacher on one grade level with the ratings of another teacher on another grade level. By design and procedure, it is loose and risky.

No comparable achievement test data were available for comparison of post-H. flu meningitic children with their hospitalized controls. However, the Otis-Lennon Mental Ability Test was administered frequently and broadly enough to supply data from cumulative records on fifteen pairs of subjects. Results of that "t"-test are shown below and the probability for "F" is of arresting importance. In visually comparing IQ's of index with matched controls, two index subjects were noted to be more than 30 IQ points higher than their paired controls. With these two pairs of subjects deleted from the groups, a "t"-test of the thirteen remaining pairs generates a $p \leq .0073$. Though such an analysis is hardly sound statistical procedure, it does nevertheless point out the extreme variability within the post-H. flu meningitic group, and it illustrates the investigators' challenge in sifting data for their optimal function while meeting sound procedure.

Essentially, analysis by "t"-tests for pairs of index and hospitalized non-meningitic control subjects along variables of teacher appraisal and group IQ generated little of significance. The variability in scores, the limited sample, and vagaries of matching subjects are apparent.

To compare the four related groups, other statistical procedures were employed. In addition to the control variables of sex, race, classroom membership, age, and age at hospitalization, complete data were secured on length of hospitalization, IQ, overall scholastic rating, and the forty-four Teacher Appraisals for all subjects. It must be noted again that of the forty-four Teacher Appraisal variables, seven were factual and provided background information while thirty-seven may be taken as evidence of behavior and maybe employed as a composite variable, "Teacher Rating Summary."

In order to make full use of the control-variable information, a multiple regression technique was selected. Teacher Appraisal items 8-44 summated into one "Teacher Rating Summary" may be assumed to approximate normal distribution and satisfy the requirement of multiple regression for the dependent variable.

Multiple regression is a statistical method of predicting the values of the dependent variable as a linear combination of the values of independent or dummy variables by a mathematical model of the form

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3 + - - - + \text{error}.$$

A least squares solution for such an equation is found to minimize the squared error between predicted and observed values of the dependent variable. The fit between predicted and observed values is measured by a correlation coefficient, the multiple R, for each "model." (see Appendix G.)

Any two models may be statistically compared provided the "full" model utilizes all the information employed by the "restricted" model. The efficiencies of two such models are compared by a variance-ratio test (F test), and an associated probability (that the full model is a better predictor than the restricted model) is assigned.

With "Teacher Rating Summary" as dependent variable, multiple regression may be used to predict from sex, age, race (as control variables); and various combinations of sample groups (1) post-H. flu meningitic, (2) classmate controls for index, (3) hospitalized controls, and (4) classmate controls for hospitalized controls, with age at hospitalization as test variables. The most significant results are obtained when post-H. flu meningitis survivors and non-meningitic hospitalized controls (groups 1 and 3) against respective classmate controls (groups 2 and 4) are used to predict "Teacher Rating Summary," controlling for age, sex, and race, ($R^2 = .15$; $F = 11.06$; $p = .0018$).

Support for this conclusion is obtained from a multiple discriminant analysis. Three functions are derived to discriminate amongthe four sample groups. Of these only one is significant ($p = .0004$). Its major loadings are age at hospitalization (-.793) and Teacher Rating Summary (.617). An F test of Teacher Rating Summary predicts from all four sample groups ($df = 3$, $F = 3.695$, $p = .0159$). It is clear from examination of the means, shown in Table 5, that practically all the variance of this test is contributed by post-H. flu meningitis and non-meningitis (groups 1 and 3) against classmate controls (groups 2 and 4).

Table 5

Comparison of Simple and Regression Means of Four Groups on 37 Teacher Ratings (Summated); Regression Means as Differentials with "Fours" as Baseline, after Controlling for Sex, Age, and Race

	Group Means, Simple	Simple Delta	Regression Delta, Controlled	
Fours (Baseline)	159.3	0.0	0.0	0.0
Twos	158.7	-0.6	-1.3	
Threes	140.3	-19.0	-19.0	-20.8
Ones (Post-H. Flu)	136.6	-22.7	-23.8	

Comparison of sample and regression deltas confirm that group differences associated with the control variables sex, age, and race are negligible, as the sample design was intended to insure.

The overall mean for Teacher Rating Summary is 147.6; standard deviation is 27.2. The 20.8 difference between ones-threes and twos-fours (delta) is equivalent to a mean change from yes to no (or vice versa) on about five of the thirty-seven teacher ratings, and approaches a standard deviation.

It appears that children in the New Orleans sample who have suffered H. flu meningitis or equivalent hospitalization for shigella or salmonella are significantly impaired by comparison with their classmates, and about equally so. Since the equivalent hospitalization group had very debilitating diseases with some similar symptoms, it is not surprising that the degree of impairment should be about the same.

CHAPTER IV

RESULTS AND RECOMMENDATIONS

This study was initiated to implement recommendations of previous studies by the same research consortium. The objectives were to expand the sampling of children surviving meningitis to include other communities and to restrict the sample of those children who had survived Haemophilus influenza meningitis.

The results of this study and recommendations growing from it will be reported in the following sections of this chapter.

Results

A review of professional literature indicates the high prevalence, profound seriousness, and debilitating sequelae of Haemophilus influenza meningitis. More than thirty topics associated with H. flu meningitis are covered in the literature annotated in Appendix A. of this report. Essentially, this body of literature indicates that survivors of H. flu meningitis may have subtle sequelae which will impair to varying degrees their ability to adjust in school and subsequent adult life.

Previous studies by this research team suggest that the post-meningitic child may have difficulties in instructional receptivity, student image, gross motor coordination, fine motor coordination and other coordination dimensions. When compared with matched classmates on the basis of age, sex, and socio-economic status, the post-meningitic children have been found to have poorer academic achievement, more reading difficulty, and poorer general overall school adjustment.

Data gathered on post-H. flu meningitic children in Dallas, Texas and New Orleans, Louisiana confirm previous studies while expanding the size and geographic breadth of the sampling. Comparisons of the post-H. flu children with non-meningitic classmates of the same age, sex, and socio-economic class show significant differencesand suggest that the post-H. flu children fit remarkably well into the general subjective description of the child considered to have minimal brain dysfunction or perceptual handicap. He has poor coordination, reads below grade level, has difficulty with peers, is careless, his academic achievement is very uneven and he manifests little or no originality. He also appears to be much more easily angered and is easily frustrated in unstructured situations. His school achievement appears to be significantly poorer than his matched classmates with test items related to coordination and reasoning perhaps the most clearly impaired.

Differences between survivors of H. flu meningitis and other infectious disease with high fevers and physical difficulties such as shigella and salmonella are less clear. When H. flu meningitis survivors are compared with survivors of shigella and salmonella contracted at the same age, distinct differences were slightly directional but not significant. Limited sampling size may have exaggerated the effect exercised by one or two subjects on total data analysis. However, when H. flu meningitis and shigella survivors were pooled and compared with their classmates who had no history of these diseases, they were viewed as having many more school problems than the non-hospitalized children.

Results of this present project confirm that the child who has suffered infectious disease two years prior to school entrance is far less likely to make an adequate school adjustment than his classmates who have fortunately been free of serious disease. These differences are most apparent when hospitalized are contrasted with non-hospitalized, but the relative residua of meningitis and shigella remain shrouded. The gross differences between infectious disease survivors and those who have not had disease are manifestly clear.

Possible Pre-School Intervention. A second aspect of the research program and this project has been the exploration and articulation of programs to prevent adjustment problems among post-meningitic children if warranted by the findings. Variables used in preliminary examinations were selected on the basis of their relevance for pre-school behavior patterns. Psychological tests, such as the ITPA, the Frostig, and PPVT were selected in part because they were extended down to encompass the 2 year old level of performance. Neurological and psychiatric items have precursors rooted in earlier stages of life, though not always as clear and surely not as objective as psychological tests.

Therefore, the patterns of deficit experienced by post-meningitic children may be useful guides for pre-school screening and intervention to ameliorate or prevent subsequent school adjustment problems. In the area of intellectual receptivity, the value of psychological instruments such as the ITPA, Frostig, and PPVT has been demonstrated with this group of children; and, since norms for these tests reach into the pre-school level, they should be of value for pre-school screening as well. Other standardized test procedures which have been demonstrated to be highly correlated with performance on these three instruments and which are more brief would also be applicable. Commercially produced remediation materials based upon work with these three standardized instruments is becoming available and could be used in the home by parents with a minimum of supervision.

In addition, pre-school intervention should include home visits wherein parents are encouraged to offer a variety of enriching experience for their children who have suffered acute bacterial meningitis. A concerted effort should be made to provide the child with many experiencesof the following types: activities to accentuate verbal organization and expression; games requiring matching colors, matching objects to colors, words to colors, and objects to words; structured situations to emphasize likenesses, differences, and comparisons in the environment; repeatedly highlighting details for association; games requiring transposing of input and output; games in which a productive cognitive style is emphasized.

Observations on the student image of post-meningitic children were derived from teacher and peer characterizations of these children. The post-meningitic children in general had a low visibility, were quiet and on the fringe of activities, and apparently were not as active and aggressive as the control children. Personality assessment techniques for characteristics of this nature are not yet reliable for the pre-school level. Unfortunately, to date, only the observations of well-trained pre-school group leaders provide the best clues as to whether children are developing effective competitive personalities. Logically, then, post-meningitic children should be encouraged quite early to participate in structured pre-school situations such as community center activity groups, nursery schools, and kindergartens. At home these children should have special help with games played with peers. They should be exposed to an especially active and exciting life to encourage spontaneity. Perhaps they should be encouraged to play with younger children to foster competition, confidence, and even dominance. Special caution should be exercised to prevent their being overwhelmed in competitive play with other more assertive peers.

The small, less well-identified factors which pointed to a poor capacity for neurological integration may be even more difficult to trace to pre-school training and intervention practices. Results of the nationwide study on child development under the auspices of the National Institute for Neurological Diseases and Blindness when published should provide some clues concerning the roots of clumsy, inept behavior among children who are slow to react and hesitant to engage in activities. With some caution, it would be safe to generalize that the post-meningitic pre-school child requires special attention in posture and movement patterns. Emphasis should be given to rhythmic movement and gracefulness of action. In addition to the play situations experienced by all children, there are strong indications that these children need special guidance in dance and gymnastic activities. An increasing body of research points to the importance of games which go beyond agility and strength in clarifying body mechanics in terms of tenseness and relaxation of muscles and limbs. These children may need special instruction on how the body operates and on how they are to operate it.

Procedures for implementing the screening and pre-school intervention for post-meningitic children might conceivably vary from community to community. What is important is that the child and family receive some special guidance and supervision prior to the post-meningitic child's entrance into regular school programs. In **areas** where hospital affiliated social service follow-up is common practice, the family and post-meningitic child could be routinely visited by medical social workers alert to the potential problems of children surviving acute bacterial meningitis.

But of more likely value would be the practice of medical authorities advising the school health service when a child has been dismissed from the hospital as being cured of acute bacterial meningitis. School health services could then place the post-meningitic child and his family under their educational wing and initiate pre-school preparation for eventual school entrance. Depending on the depth of school health services and the staffing patterns, the post-meningitic child and his family would be visited by a home visitor, a school health nurse, a school social worker, or whatever discipline the existing school policies would provide. With clear orientation toward successful school adjustment in mind, the educationally oriented pre-school screening and intervention would likely be more remediation and school-readiness oriented than would be the medical model. In addition, the vast array of ancillary educational services would be readily available for particularly knotty problems.

Implementation of Findings. The third objective of this project was to develop and sustain interdisciplinary and inter-institutional involvement in the pilot study to prepare for implementation of the findings. Results of this phase have been rewarding and hold great promise for future collaborative effort.

Representatives from Emory University Medical School and Atlanta, Georgia Schools; from University of Tennessee School of Medicine and Memphis, Tennessee Schools; from University of Texas Medical College and Dallas, Texas Public Schools; from Vanderbilt University School of Medicine and Metropolitan Nashville, Tennessee Schools; and from Tulane University School of Medicine and New Orleans, Louisiana Schools were enthusiastically cooperative in all stages of the pilot study and this project. Interdisciplinary research stimulates examination of the same data from various viewpoints. Of the completed publications growing from this research program, some are in pediatric literature, others in special education literature, and one is within the area of scientific reference work. The several manuscripts in preparation are directed toward professional literature of psychology, special education, physcial education, neurology, psychiatry, and pediatrics. Papers have been presented to education, special education, pediatric, public health, and mental health societies.

Recommendations

In light of the findings of this study, it would seem warranted to initiate a program which would test the effectiveness of pre-school screening and intervention in order to reduce school adjustment problems among post-meningitic children. This could be accomplished by mounting a prospective study in several communities to insure adequate sampling and generalized professional practice (as opposed to the impact of one group of personalities in one specific community). In each of the cooperating communities, educators and medical advisors would identify 30 or more post-meningitic children two years prior to school admission and randomly assign them to one of three groups. Group I would receive a school oriented follow-up through school health channels preparatory to school enrollment. Group II would receive a medically oriented follow-up and be visited and counseled by the traditional medical practice in that community. Group III would receive statistical follow-up without any pre-school contacts.

The three groups would be matched with non-post-meningitic control children when they entered school. These post-meningitic children would be followed from the date of identification which would be two years before school entrance until they had completed the third grade, at which time the three strategies of intervention could be compared and the most effective route determined.

Predictive measures, formulated from data accumulated in this program and from professional experience, could be validated as results from the prospective studies become available. It would be essential for the design to include more than one research site and more than one professional staffing pattern if the results of these many years of preliminary work are to be afforded a fair test.

REFERENCES

Clements, S. Minimal brain dysfunction in children. Number 3, National Institute of Neurological Disease and Blindness, 1966, 1-18.

Dodge, P. and Swartz, M. Bacterial meningitis: a review of selected aspects. II. Special neurological problems, post-meningitic complications and clinicopathological correlations. New England Journal of Medicine, 1965, 272, 1003-1010.

Dunn, L. Minimal brain dysfunction: a dilemma for educators. George Peabody College, Institute on Mental Retardation and Intellectual Development, Papers and reports. Vol. II, No. 1, 1965.

Galloway, H. Acute Pyogenic meningitis in children in the Northeast of Scotland. Scotland Medical Journal, 1966, 11, 119-127.

Haggerty, R. and Ziai, M. Acute bacterial meningitis. Advances in Pediatrics, 1964, 13, 129-181.

Hutchinson, P. and Kovacs, M. The sequelae of acute purulent meningitis in childhood. Canadian Medical Association Journal, 1963, 89, 158-166.

Johnson, E. A study of psychological findings of one hundred children recovering from purulent meningitis. Journal of Clinical Psychology, 1960, 16, 55-61.

Kresky, B.,Buchbinder, S. and Greenberg, I. The incidence of neurologic residua in children after recovery from bacterial meningitis. Archives Pediatrics, 1962, 79, 63-71.

Sell, S., Oliver, M., Pate, J., and Solomon, A. An Annotated Bibliography of the Sequelae of Acute Bacterial Meningitis, 1969.

Webb, W., Sell, S., Pate, J., Solomon, A. The sequelae of acute bacterial meningitis: a possible clue to early school problems. The Journal of Special Education, 1968, 4, 383-396.

TABLE OF APPENDICES

A. AN ANNOTATED BIBLIOGRAPHY OF THE SEQUELAE OF ACUTE BACTERIAL MENINGITIS

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APPENDIX A.

AN ANNOTATED BIBLIOGRAPHY OF THE SEQUELAE OF ACUTE BACTERIAL MENINGITIS

1. ACERS, T. E. AND COOPER, W. C. CORTICAL BLINDNESS SECONDARY TO BACTERIAL MENINGITIS. AMER. J. OPHTHAL. 59: 226-229, (Feb.), 1965.

Two cases of bacterial meningitis were reported in which cortical blindness was a symptom and sequela. The hospital course and method of treatment was described.

ETIOLOGIC AGENTS:
Diplococcus pneumoniae
Hemophilus influenzae
SEQUELAE:
Cortical blindness, severe brain damage.
RESEARCH CENTER:
The Ophthalmology Section, Surgical Service, and Pediatric Section, Medical Service, U. S. Army Hospital, Fort Sill Oklahoma.
REFERENCES:
12

2. ADAMS, R. D. AND KUBIK, C. S. THE EFFECTS OF INFLUENZAL MENINGITIS ON THE NERVOUS SYSTEM. NEW YORK STATE J. MED. 47: 2676-2682, (Dec. 15), 1947.

Three cases of influenzal meningitis were reported in which the most common symptoms were drowsiness, convulsions, and fever. Early diagnosis was emphasized and the therapy discussed.

ETIOLOGIC AGENTS:
Staphylococcus aureus
Hemophilus influenzae
SEQUELAE:
Death, permanent brain damage.
RESEARCH CENTER:
The Department of Neurology, Harvard Medical School, The Neurological Unit, Boston City Hospital, and The Department of Neurology, Massachusetts General Hospital.
REFERENCES:
1

3. ALEXANDER, H. E., LEIDY, G., RAKE, G., AND DONOVICK, R. HEMOPHILUS INFLUENZAE MENINGITIS TREATED WITH STREPTOMYCIN. J.A.M.A. 132: 434-440, (Oct. 26), 1946.

An analysis was presented of 25 patients treated with streptomycin alone or combined with other agents. Those patients who presented less severe evidence of meningitis appeared to respond well to streptomycin alone, while the severe cases required the use of rabbit antiserum, sulfadiazine, and streptomycin.

ETIOLOGIC AGENTS:
Hemophilus influenzae
SEQUELAE:
Death, deafness.

RESEARCH CENTER:
The Babies Hospital and The Department of Pediatrics, Columbia University College of Physicians and Surgeons, and The Squibb Institute for Medical Research.
REFERENCES:
10

4. APPELBAUM, E. MENINGITIS FOLLOWING TRAUMA TO THE HEAD AND FACE. *J.A.M.A.* 173: 1818-1822, (Aug. 20), 1960.

In 91 cases of post-traumatic meningitis a fractured skull was present in over half of the cases. The average interval between injury and illness was two weeks. Significant symptoms were bleeding from the nose and ears and cerebrospinal fluid rhinorrhea or otorrhea.

ETIOLOGIC AGENTS:
- Pneumococcus
- Streptococcus
- Staphylococcus
- *Hemophilus influenzae*
- Meningococcus
- *Klebsiella pneumoniae*
- "Others"

SEQUELAE:
Death, deafness, unilateral blindness, mental impairment.
RESEARCH CENTER:
Bureau of Laboratories, Department of Health, New York.
REFERENCES:
17

5. APPELBAUM, E. AND ABLER, C. ADVANCES IN THE DIAGNOSIS AND TREATMENT OF ACUTE PYOGENIC MENINGITIS. *NEW YORK STATE JOURNAL OF MEDICINE* 58: 204-211, (Jan. 1), 1958.

A research study into the most effective drug treatment of various types of meningitis was presented. The article discussed clinical aspects, laboratory studies, and chemotherapy of the illness.

ETIOLOGIC AGENTS:
- Listerella
- *Neisseria pharyngis*
- *Bacillus evanidus*
- Sporotrichum
- *Micrococcus tetragenus*
- *Unclassified organisms*
- Meningococcus
- Pneumococcus
- Streptococcus
- *Hemophilus influenzae*
- Staphylococcus
- *Escherichia coli*
- *Pseudomonas aeruginosa*
- *Klebsiella pneumoniae*
- Cryptococcus
- Actinomyces
- Salmonella
- *Bacillus proteus*
- *Neisseria catarrhalis*
- *Streptococcus typhosa*

SEQUELAE:
Arthritis, deafness, uveitis.
RESEARCH CENTER:
Bureau of Laboratories, New York City, Department of Health.
REFERENCES:
80

6. ARNOLD, G. G. PURULENT AND SEROUS SUBDURAL EFFUSIONS IN THE COURSE OF PURULENT MENINGITIS. J. PEDIAT. 39: 191-196, (Aug.), 1951.

An analysis of four cases of purulent meningitis admitted to Children's Hospital in the last six months of 1950 was presented. Subdural effusions complicated each case. The most common indications of subdural effusions were given and a method of therapy was suggested.

ETIOLOGIC AGENTS:
Diplococcus pneumoniae
Hemophilus influenzae

SEQUELAE:
Diffuse brain damage, hydrocephalus, focal necrosis, subdural effusion.

RESEARCH CENTER:
The Children's Memorial Hospital and The Department of Pediatrics, McGill University.

REFERENCES:
6

7. BLOOR, B. M., GRANT, R. S., AND TABRIS, J. A. SEQUELAE OF MENINGITIS DUE TO HEMOPHILUS INFLUENZAE: ANALYSIS OF 44 CASES. J.A.M.A. 142: 241-243, (Jan. 28), 1950.

A study of 44 patients who had meningitis between 1945 and 1948 showed that the sequelae were affected by seasonal variation, age distribution, and the appearance and severity of convulsions. Neurologic and electroencephalographic tests were given.

ETIOLOGIC AGENTS:
Hemophilus influenzae

SEQUELAE:
Death, deafness, facial weakness, reflex change, hydrocephalus, bilateral pyramidal signs, bilateral nerve deafness, hemiparesis, retarded developmental level, behavior problems, slow activity, focal abormality, amplitude asymmetry, generalized disrhythmia.

RESEARCH CENTER:
Departments of Pediatrics and Neurology, University of Louisville School of Medicine, Louisville, Kentucky.

REFERENCES:
0

8. BOE, J. AND HUSEKLEPP, H. RECURRENT ATTACKS OF BACTERIAL MENINGITIS. A "NEW" CLINICAL PROBLEM. REPORT OF FIVE CASES. AMER. J. MED. 29: 465-475, (Sep.), 1960.

Recurrent attacks of bacterial meningitis were associated with previously encountered skull fracture or craniopharyngeal fistula which permitted the escape of cerebrospinal fluid into the nasopharynx.

ETIOLOGIC AGENTS:
Pneumococcus
Meningococcus
Hemophilus influenzae

SEQUELAE:
Deafness.

RESEARCH CENTER:
University of Bergen School of Medicine, Medical Department B, Bergen, Norway.

REFERENCES:
26

9. CARPENTER, R. R. AND PETERSDORF, R. G. THE CLINICAL SPECTRUM OF BACTERIAL MENINGITIS. AMER. J. MED. 33: 262-275, (Aug.), 1962.

A retrospective study of 209 patients admitted to King County Hospital between 1950 and 1960, who were suffering from meningitis, included a discussion of the disease in regards to: etiology, incidence, clinical history, physical findings, associated diseases, complications, recurrent infections, cerebrospinal fluid, prognosis and treatment.

ETIOLOGIC AGENTS:
Meningococcus
Pneumococcus
Hemophilus influenzae
Escherichia coli
Staphylococcus
Streptococcus
Paracolon
Diptheroid
Mixed infections
Unknown agents

SEQUELAE:
Death, subdural effusions, deafness, headaches, hearing defects, dizziness, dementia, convulsive disorder, hemiparesis, oculomotor palsy.

RESEARCH CENTER:
Department of Medicine, University of Washington School of Medicine and King County Hospital, Seattle, Washington.

REFERENCES:
43

10. CARSON, M. J. AND KOCH, R. MANAGEMENT OF BACTERIAL MENINGITIS IN CHILDREN. PEDIAT. CLIN. NORTH AMERICA (3): 377-398, (May), 1956.

In a review of 354 cases of meningitis admitted between 1944 and 1953, the clinical syndrome, differential diagnosis, and agents of the disease were discussed. The preferred treatment for complications was included.

ETIOLOGIC AGENTS:
Hemophilus influenzae
Meningococcus
Pneumococcus
Escherichia coli
Salmonella
Staphylococcus
Streptococcus
Pseudomonas
Paracolon
Proteus
Unknown

SEQUELAE:
Death, subdural effusions, hydrocephalus.

RESEARCH CENTER:
The Los Angeles Children's Hospital and The Department of Pediatrics, University of Southern California School of Medicine, Los Angeles.

REFERENCES:
86

11. CROOK, W. G., CLANTON, B. R., AND HODES, H. L. HEMOPHILUS INFLUENZAE MENINGITIS: OBSERVATIONS ON TREATMENT OF 110 CASES. PEDIATRICS 4: 643-658, (Nov.), 1949.

A review and evaluation of 110 cases of meningitis admitted during the years 1941 and 1948 was presented. Age at onset and delay in treatment were important factors in the recovery from the illness.

ETIOLOGIC AGENTS:

Hemophilus influenzae

SEQUELAE:

Death, spastic hemiplegia, mental retardation, hydrocephalus, cortical atrophy, blindness, deafness.

RESEARCH CENTER:

Sydenham Hospital, Baltimore City Health Department,
The Harriet Lane Home of the Johns Hopkins Hospital,
Baltimore, Maryland.

REFERENCES:

36

12. DAVIES, J. A. V., MEYER, E., AND HYDE, H. FOLLOW-UP STUDY OF PATIENTS WHO HAVE RECOVERED FROM MENINGITIS. AM. J. DIS. CHILD. 79: 958-961, (May), 1950.

One hundred and five children who had suffered meningitis between the years 1940 and 1947 were studied by physical and psychological testing three months to eight years after the initial illness.

ETIOLOGIC AGENTS:

Pneumococcus
Meningococcus
Hemophilus influenzae

SEQUELAE:

Severe motor damage, mental damage, behavior disturbances.

RESEARCH CENTER:

Boston.

REFERENCES:

0

13. DESMIT, E. M. A FOLLOW-UP OF 110 PATIENTS TREATED FOR PURULENT MENINGITIS. ARCH. DIS. CHILDHOOD 30: 415-418, (Oct.), 1955.

One hundred ten patients who suffered from purulent meningitis between October 1949 and March 1954 were checked six months or more after discharge from the hospital. Sequelae, effects of therapeutic drugs and causes of residual effects were discussed.

ETIOLOGIC AGENTS:

Hemophilus influenzae
Meningococcus
Pneumococcus
Streptococcus
Bacterium coli

SEQUELAE:

Death, convulsions, ataxia, spastic arms and legs, deafness hydrocephalus, aphasia, alexis, agraphia.

RESEARCH CENTER:

The Juliana Kinderziekenhuis, The Hague.

REFERENCES:

3

14. DODGE, P. R. AND SWARTZ, M. N. BACTERIAL MENINGITIS-A REVIEW OF SELECTED ASPECTS. II. SPECIAL NEUROLOGIC PROBLEMS, POST-MENINGITIC COMPLICATIONS AND CLINICOPATHOLOGICAL CORRELATIONS. NEW ENG. J. MED. 272: 954-960 contd., (May 6), 1965.

A study of 207 patients who were treated between 1956 and 1962 discussed altered consciousness, seizures, focal cerebral signs, cranial nerve signs, and the problem of increased intracranial pressure as associated with bacterial meningitis.

ETIOLOGIC AGENTS:

Diplococcus pneumoniae
Hemophilus influenzae
Neisseria meningitidis
Streptococcus
Escherichia coli
Staphylococcus aureus
Pseudomonas aeruginosa
Pasturella multocide
Clostridium perfringens
Proteus
Listeria monocytogenes
Unknown

SEQUELAE:

Death, deafness, hemiparesis, triplegia, dysphasia, cerebellar herniation.

RESEARCH CENTER:

Department of Medicine and Neurology, Harvard Medical School, and Neurologic, Children's and Medical (Infectious Disease Unit), Services and Joseph P. Kennedy, Jr. Memorial Laboratories, Massachusetts General Hospital.

REFERENCES:

21

15. DODGE, P. R., AND SWARTZ, M. N. BACTERIAL MENINGITIS-A REVIEW OF SELECTED ASPECTS. II. SPECIAL NEUROLOGIC PROBLEMS, POST-MENINGITIC COMPLICATIONS AND CLINICOPATHOLOGICAL CORRELATIONS. *NEW ENG. J. MED.* 272: 1003-1010 concl., (May 13), 1965.

Some of the effects of meningitis on the nervous system were discussed with emphasis on subdural effusion.

ETIOLOGIC AGENTS:

Hemophilus influenzae
Meningococcus
Pneumococcus

SEQUELAE:

Peripheral nerve damage, death, subarachnoid hemorrhage seizures, subdural effusions.

RESEARCH CENTER:

Department of Neurology and Medicine, Harvard Medical School, The Neurological Children's and Medical Services, and The Joseph P. Kennedy, Jr. Laboratory of the Massachusetts General Hospital.

REFERENCES:

31

16. EIGLER, J. O., WELLMAN, W. E., ROOKE, E. D., KEITH, H. M., AND SVIEN, H. J. BACTERIAL MENINGITIS. I. GENERAL REVIEW (294 CASES). *PROC. MAYO CLIN.* 36: 357-365, (Jul. 19), 1961.

A detailed analysis was presented of 294 cases of meningitis admitted to the clinic between the years 1948 to 1958. Special attention was paid to 116 patients suffering from meningitis caused by uncommon bacteria and to 141 patients simultaneously suffering from meningitis and an underlying disease.

ETIOLOGIC AGENTS:

Streptococcus
Staphylococcus aureus
Neisseria meningitidis
Diplococcus pneumoniae

Haemophilus influenzae
Unknown
"Other"
SEQUELAE:
Death.
RESEARCH CENTER:
Mayo Clinic.
REFERENCES:
9

17. FORTUINE, R. ACUTE PURULENT MENINGITIS IN ALASKA NATIVES. EPIDEMIOLOGY, DIAGNOSIS, AND PROGNOSIS. *CANAD. MED. ASS. J.* 94: 19-22, (Jan. 1). 1966.

In a study of 69 patients who had purulent meningitis, special attention was paid to the problems involved in serving the inhabitants of Southwestern Alaska.

ETIOLOGIC AGENTS:
Pneumococcus
Meningococcus
Hemophilus influenzae
Staphylococcus pyogenes
Staphylococcus
Unknown
SEQUELAE:
Death, convulsive disorders, mental retardation, motor weakness or paralysis, strabismus, visual defect, deafness.
RESEARCH CENTER:
Alaska Native Hospital, Bethel, Alaska.
REFERENCES:
3

18. FRENCH, J. D. BACTERIAL MENINGITIS IN INFANTS AND CHILDREN. *VIRGINIA M. MONTH.* 84: 123-127, (Mar.), 1957.

An analysis of 150 cases, admitted to the Medical College of Virginia between January 1953 and January 1956, discussed bacterial meningitis in regards to age, seasonal incidence, etiology, symptoms, signs, laboratory findings, therapy, complications, otitis media, and mortality.

ETIOLOGIC AGENTS:
Meningococcus
Hemophilus influenzae
Pneumococcus
Escherichia coli
Proteus
Pseudomonas
Salmonella
Unknown
SEQUELAE:
Deafness (partial and complete), hydrocephalus, sixth nerve paralysis, mental retardation without hydrocephalus, aphasia, mental and developmental regression, behavior problem, facial paralysis.
RESEARCH CENTER:
Pediatric Service of the Medical College of Virginia.
REFERENCES:
10

19. GALLOWAY, H. ACUTE PYOGENIC MENINGITIS IN CHILDREN IN THE NORTH-EAST OF SCOTLAND. *SCOT. MED. J.* 11: 119-127, (Apr.), 1966.

A retrospective follow-up study of 287 cases of acute

pyogenic meningitis, which occurred between 1946 and 1961, emphasized epidemiology, types of meningitis, urban and rural distribution, seasonal incidence, sex incidence, age incidence, deaths, sequelae, and mechanism of brain damage.
ETIOLOGIC AGENTS:
Meningococcus
Pneumococcus
Hemophilus influenzae
Coliform bacilli
Unidentified
Mixed infections
SEQUELAE:
Death, impaired intellect, behavior problems, deafness, lack of concentration, hydrocephalus, hemiplegia, petit mal, mental retardation, slow development, grand mal epilepsy.
RESEARCH CENTER:
Department of Child Health, University of Aberdeen, Royal Aberdeen Hospital for Sick Children and City Hospital, Aberdeen.
REFERENCES:
28

20. GORDON, R. R. MENINGEAL INFECTIONS IN CHILDHOOD. PRACTITIONER 194: 343-349, (Mar.), 1965.
A review of purulent, viral, and tuberculous infections in children discussed the cause of the illness, its course, and the prescribed treatment for each type.
ETIOLOGIC AGENTS:
Coliform bacilli
Meningococcus
Hemophilus influenzae
Pneumococcus
Streptococcus
SEQUELAE:
Hydrocephalus, subdural effusion, convulsions, epilepsy, deafness, mental retardation, behavior and personality defect, visual defect.
RESEARCH CENTER:
Children's Hospital and City General Hospital, Sheffield.
REFERENCES:
0

21. GOSSAGE, J. D. ACUTE PURULENT MENINGITIS IN CHILDREN. EXPERIENCE AT THE HOSPITAL FOR SICK CHILDREN, TORONTO. CAND. MED. ASS. J. 90: 615-617, (Mar. 7), 1964.
In a study of 68 cases of meningitis admitted during the year 1962, emphasis was placed on the etiological aspects of the disease, clinical manifestations, general principles of management of patients, and factors of significance in prognosis.
ETIOLOGIC AGENTS:
Hemophilus influenzae
Pneumococcus
Meningococcus
Escherichia coli
Tubercle bacillus
Proteus mirabilis
Unknown
SEQUELAE:
Death.
RESEARCH CENTER:
Department of Pediatrics, The Hospital for Sick Children, Toronto.
REFERENCES:
0

22. GRANT, K. B., ICHAPORIA, R. N., JOSHI, S. K., AND WADIS, R. S. MENINGITIS DUE TO *HAEMOPHILUS INFLUENZAE*. *J. ASS. PHYSICIANS INDIA* 13: 619-626, (Aug.), 1965.

In a review of 25 cases of meningitis the incidence, clinical features, diagnosis, course, and treatment of the cases were discussed. Thirty-six percent of the cases were adults.

ETIOLOGIC AGENTS:
Haemophilus influenzae

SEQUELAE:
Death, mental retardation, hydrocephalus, hemiparesis, seizures.

RESEARCH CENTER:
Ruby Hall Nursing Home, Poona-1.

REFERENCES:
21

23. HAARANEN, A., MIETTINEN, P., AND WASZ-HOCKERT, O. OPHTHALMOLOGICAL SYMPTOMS IN BACTERIAL AND SEROUS MENINGITIS. *ANN. PAEDIAT. FENN.* 7: 283-289, 1961.

A review of 100 children treated for serous meningitis between 1947 and 1959 and 100 children treated for bacterial meningitis between 1954 and 1959 indicated that disturbed function of the pupil was the most common symptom in fatal cases. The correlation of eye symptoms with other factors in the illnesses was discussed.

ETIOLOGIC AGENTS:
Hemophilus influenzae
Staphyloccus aureus
Streptococcus pneumoniae
Unknown

SEQUELAE:
Death.

RESEARCH CENTER:
The Ophthalmic and Children's Hospitals University of Helsinki.

REFERENCES:
12

24. HAGGERTY, R. J., AND ZIAI, M. ACUTE BACTERIAL MENINGITIS. *ADVANCES PEDIAT.* 13: 129-181, 1964.

A review of several aspects of bacterial meningitis emphasized etiology, diagnosis and treatment. Special problems such as neonatal meningitis, recurrent meningitis, simultaneous multiple infection, prophylaxis and prevention were reviewed.

ETIOLOGIC AGENTS:
Hemophilus influenzae
Neisseria meningitidis
Diplococcus pneumoniae
Unknown

SEQUELAE:
Mental retardation, organic behavior problems, deafness, hemiplegia, seizures, speech problems.

RESEARCH CENTER:
Department of Pediatrics, Harvard Medical School, and The Department of Medicine, Children's Hospital Medical Center, Boston, Massachusetts, and The Nemozee Hospital, Shiraz, Iran.

REFERENCES:
174

25. HAGGERTY, R. J. AND ZIAI, M. ACUTE BACTERIAL MENINGITIS IN CHILDREN. A CONTROLLED STUDY OF ANTIMICROBIAL THERAPY, WITH PARTICULAR REFERENCE TO COMBINATIONS OF ANTIBIOTICS. PEDIATRICS 25: 742-747, (May), 1960.

A study was designed to prove whether single drugs were more or less efficient than multiple drugs in therapy of meningitis. It was found that the results from the two approaches were similar. Multiple drugs were considered to be better if the etiologic agents were not identified immediately.

ETIOLOGIC AGENTS:
Hemophilus influenzae
Neisseria meningitidis
Diplococcus pneumoniae
Unknown

SEQUELAE:
Hemiplegia, blindness, deafness, hydrocephalus, ataxia, questionable retardation, excessive withdrawal.

RESEARCH CENTER:
Department of Pediatrics, Harvard Medical School, and The Department of Medicine, Children's Hospital Medical Center, Boston.

REFERENCES:
10

26. HERWEG, J. C., MIDDELKAMP, J. N., AND HARTMEN, A. F., SR. SIMULTANEOUS MIXED BACTERIAL MENINGITIS IN CHILDREN. J. PEDIAT. 63: 76-83, (Jul.), 1963.

Of 534 patients with bacterial meningitis, 20 were diagnosed as suffering from infection by two bacterial species. Most were young infants. The mortality and sequelae rates were high. Accurate and immediate diagnosis was an essential pre-requisite to prompt therapy and recovery.

ETIOLOGIC AGENTS:
Hemophilus influenzae
Neisseria meningitidis
Diplococcus pneumoniae
Streptococcus pyogenes
Staphylococcus
Aerobacter aerogenes
Salmonella enteritidis
Pseudomonas aeruginosa
Escherichia coli
Mixtures of the above

SEQUELAE:
Death, mongolism, febrile convulsions, mental retardation, hydrocephalus, grand mal seizures, left hemiparesis, convulsive disorder, behavior disturbances, partial deafness, ataxia, low I. Q.

RESEARCH CENTER:
Department of Pediatrics, Washington University School of Medicine and The St. Louis Children's Hospital, St. Louis, Missouri.

REFERENCES:
24

27. HEYCOCK, J. B. AND NOBLE, T. C. PYOGENIC MENINGITIS IN INFANCY AND CHILDHOOD. BRIT. MED. J. 5384: 658-662, (Mar. 14), 1964.

A study of 337 cases of pyogenic meningitis which occurred between 1950 and 1962 in children of newborn age to 12 years old revealed decreases in the occurrence of meningococcal meningitis, while the numbers of cases due to H. influenzae

and pneumoccus increased.
ETIOLOGIC AGENTS:
Meningococcus
Hemophilus influenzae
Pneumococcus
"Others"
SEQUELAE:
Subdural effusion, mental retardation, epilepsy, hydrocephalus, deafness.
RESEARCH CENTER:
Sunderland Children's Hospital and Sunderland Infectious Diseases Hospital.
REFERENCES:
5

28. HINTON, G. G. POSTNATAL ORGANIC CAUSES OF MENTAL RETARDATION. CANAD. MED. ASS. J. 87: 501-507, (Sept. 1), 1962.

A study of organic causes of mental retardation included meningitis with late diagnosis, incomplete identification of the infecting agent, and the improper selection of therapy listed as major causes of the sequelae of meningitis.

ETIOLOGIC AGENTS:
Pneumococcus
Meningococcus
Hemophilus influenzae
Tubercle bacillus
Streptococcus
Staphylococcus
Unknown
SEQUELAE:
Mental retardation.
RESEARCH CENTER:
Children's Psychiatric Research Institute, London, Ontario, London Crippled Children's Treatment Centre, London, Ontario, and Ontario Hospital School, Cedar Springs.
REFERENCES:
35

29. HUTCHISON, P. A. AND KOVACS, M. C. THE SEQUELAE OF ACUTE PURULENT MENINGITIS IN CHILDHOOD. CANAD. MED. ASS. J. 89: 158-166, (Jul. 27), 1963.

A study of 41 children treated for meningitis between 1952 and 1956 indicated a positive correlation between severity of illness and neuropsychiatric sequelae, as well as defective intelligence, and psychological evidence of brain damage.

ETIOLOGIC AGENTS:
Meningococcus
Hemophilus influenzae
Pneumococcus
Unknown
SEQUELAE:
Death, organic brain damage, neurological abnormality, electroencephalographic abnormality, and defective brain damage.
RESEARCH CENTER:
Departments of Pediatrics and Psychiatry, Children's Hospital, Winnipeg, and The Faculty of Medicine, University of Manitoba.
REFERENCES:
24

30. JONES, H. E. SUBDURAL EFFUSIONS IN PURULENT MENINGITIS. LANCET 1: 891-893, (May 3), 1952.

Subdural effusions were indicated by continuing or rising pyrexia associated with restless anxiety and bulging fontanelle in six cases of meningitis. Subdural taps were performed when the patient failed to respond to treatment.

ETIOLOGIC AGENTS:
Hemophilus influenzae
Meningococcus
Unknown

SEQUELAE:
Subdural effusions.

RESEARCH CENTER:
The Royal Hospital, Wolverhampton.

REFERENCES:
7

31. KAUHTIO, J. AND JANSSON, E. ACUTE BACTERIAL MENINGITIS IN ADULTS. REVIEW OF 95 CASES TREATED IN 1937-56 AT THE AURORA HOSPITAL. ANN. MED. INTERN. FENN. 48: 33-43, 1959.

In a study of 95 patients 15 years of age and older who had bacterial meningitis, meningococcus was the most common agent among adolescents and adults under 40. A stiff neck was a diagnostic sign in every case. Intrathecal therapy and the simultaneous administration of several drugs were discussed.

ETIOLOGIC AGENTS:
Meningococcus
Pneumococcus
Hemophilus influenzae
Staphylococcus aureus
Escherichia coli
Streptococcus
Unknown

SEQUELAE:
Deafness, transient ocular paralysis, transient facial paralysis, motor paralysis.

RESEARCH CENTER:
The Municipal Aurora Hospital, IV Division, Helsinki.

REFERENCES:
19

32. KAUHTIO, J., PAATELA, M., AND RANTASALO, I. ACUTE BACTERIAL MENINGITIS IN CHILDREN. SURVEY OF 379 CASES TREATED FROM 1946-57. NORD. MED. 61: 177-180, (Jan. 29), 1959.

In a study of 379 patients, the age of the patient and the amount of time before initiating therapy were factors in determining the outcome of the bacterial meningitis. A suitable antibiotic was chosen by examining direct smears and cultures of cerebrospinal fluid and blood.

ETIOLOGIC AGENTS:
Neisseria meningitidis
Streptococcus pneumoniae
Hemophilus influenzae
"Others"

SEQUELAE:
Death.

RESEARCH CENTER:
Children's Hospital, University of Helsinki and The Aurora Hospital, Helsinki.

REFERENCES:
16

33. KERR, F. W., KING, R. B., AND MEAGHER, J. N. BRAIN ABSCESS. A STUDY OF 47 CONSECUTIVE CASES. J.A.M.A. 168: 868-872, (Oct. 18), 1958.

Between 1945 and 1956 two cases of meningitis were isolated from 47 cases of cerebral abscess. The source and type of infection, symptomatology, and diagnostic methods were discussed. Deterioration in consciousness was important in the timing of operations and in diagnosis.

ETIOLOGIC AGENTS:
- Streptococcus
- Staphylococcus
- Proteus
- Hemophilus influenzae
- "Other"

SEQUELAE:
Death, epilepsy, neurologic deficit.

RESEARCH CENTER:
Department of Surgery, Division of Neurological Surgery, Washington University School of Medicine, St. Louis, Missouri.

REFERENCES:
13

34. KINNEY, C. E. LOSS OF SPEECH DUE TO MENINGITIC DEAFNESS. ARCH. OTOLARYNG. 47: 303-309, (Mar.), 1948.

In a review of 29 cases of meningitic deafness loss of speech was frequent. The amount of speech loss was proportional to the age of the child and the amount of speech training previous to the illness.

ETIOLOGIC AGENTS:
- Meningococcus
- Hemophilus influenzae
- Pneumococcus
- Streptococcus

SEQUELAE:
Deafness, speech loss.

RESEARCH CENTER:
Cleveland.

REFERENCES:
0

35. KNEEBONE, G. M. PURULENT MENINGITIS IN CHILDHOOD. MED. J. AUST. 48(2): 124-130, (Jul. 22), 1961.

In a review of 237 cases of meningitis treated between 1953 and 1959, the incidence, clinical picture, diagnosis, treatment, and sequelae of the illness were discussed.

ETIOLOGIC AGENTS:
- Hemophilus influenzae
- Meningococcus
- Pneumococcus
- Unknown
- "Other"

SEQUELAE:
Death, deafness, paraplegia, hemiplegia.

RESEARCH CENTER:
The Department of Child Health, University of Adelaide.

REFERENCES:
15

36. KOCH, R., KOGUT, M., AND ASAY, L. MANAGEMENT OF BACTERIAL MENINGITIS IN CHILDREN. PEDIAT. CLIN. N. AMER. 8: 1177-1197, (Nov.), 1961.

The occurrence of meningitis in 235 children was discussed in regard to the pathogenesis, etiology, diagnosis, laboratory examinations, and treatment of the illness.

ETIOLOGIC AGENTS:

Meningococcus
Pneumococcus
Hemophilus influenzae
Staphylococcus
Streptococcus
Escherichia coli
Salmonella
Pseudomonas

SEQUELAE:

Death, residual neurologic damage, mental retardation, deafness, seizure disorder, cerebral palsy, behavior disorder, speech defect, precocious puberty.

RESEARCH CENTER:

Los Angeles Children's Hospital.

REFERENCES:

60

37. LAWSON, D., METCALFE, M., AND PAMPIGLIONE, G. MENINGITIS IN CHILDHOOD. BRIT. MED. J. 5434: 557-562, (Feb. 27), 1965.

A retrospective study of 102 patients who had suffered from bacterial and non-bacterial meningitis discussed early diagnosis, antibacterial agents, and antibiotic therapy. Below average intelligence after the illness was seen most often in children less than one year old.

ETIOLOGIC AGENTS:

Hemophilus influenzae
Meningococcus
Pneumococcus
Streptococcus
Unknown

SEQUELAE:

Emotional, behavioral, and scholastic difficulties, deafness, death.

RESEARCH CENTER:

Queen Mary's Hospital for Children, Carshalton.

REFERENCES:

6

38. LORBER, J. AND PICKERING, D. INCIDENCE AND TREATMENT OF POST-MENINGITIC HYDROCEPHALUS IN THE NEWBORN. ARCH. DIS. CHILD. 41: 44-50, (Feb.), 1966.

In 19 cases of neonatal meningitis the patient also developed post-meningitic hydrocephalus. Eighteen of these patients were treated by ventriculo-caval shunt. A complete history was given for each case.

ETIOLOGIC AGENTS:

Escherichia coli
Proteus
Meningococcus
Hemophilus influenzae
Staphylococcus aureus
Staphylococcus albus
Pneumococcus
Listeria

SEQUELAE:

Death, hydrocephalus, retardation, convulsions, blindness.

RESEARCH CENTER:

The Department of Child Health, University of Sheffield, and The Children's Hospital, Sheffield.

REFERENCES:

11

39. MCDONALD, R. PURULENT (NON-MENINGOCOCCAL) MENINGITIS IN CHILDREN. *S. AFR. MED. J.* 29: 782-785, (Sept. 25), 1965.

A review of 281 cases of purulent meningitis occurring between 1951 and 1964 showed that delay in admission to the hospital, early age, convulsions, and coma increased the chances of death or sequelae.

ETIOLOGIC AGENTS:
- Pneumococcus
- *Hemophilus influenzae*
- Miscellaneous
- No organism identified

SEQUELAE:

Spastic paralysis, hypotonia, mental retardation, hydrocephalus, cerebral atrophy, blindness.

RESEARCH CENTER:

Groote Schuur Hospital.

REFERENCES:

23

40. MCKAY, R. J., JR., INGRAHAM, F. D., AND MATSON, D. D. SUBDURAL FLUID COMPLICATING BACTERIAL MENINGITIS. *J.A.M.A.* 152: 387-391, (May 30), 1953.

In a study of 50 patients, stress was placed on the necessity of draining the subdural fluid to enable complete recovery from the illness. The conditions under which surgery was required were described.

ETIOLOGIC AGENTS:
- *Hemophilus influenzae*
- Pneumococcus
- Meningococcus
- *Hemophilus influenzae* and pneumococcus
- Staphylococcus
- Tubercle bacillus

SEQUELAE:

Not listed.

RESEARCH CENTER:

Department of Pediatrics and Surgery, Harvard Medical Center, Boston, Division of Pediatrics, University of Vermont, College of Medicine, and the Department of Pediatrics, Mary Fletcher Hospital, Burlington, Vermont.

REFERENCES:

0

41. MCKENDRICK, G. D. W. PYOGENIC MENINGITIS. *LANCET* 2: 510-512, (Sept. 11), 1954.

In an anlaysis of 107 cases of pyogenic meningitis admitted between 1948 and 1953, the age, history, state of consciousness on admission, and duration of pyrexia were given.

ETIOLOGIC AGENTS:
- Meningococcus
- Pneumococcus
- *Hemophilus influenzae*
- Staphylococcus
- Streptococcus
- Proteus
- Mixed
- Unknown

SEQUELAE:

Death.

RESEARCH CENTER:

Ham Green Hospital, Bristol.

REFERENCES:

11

42. MCNIEL, J. R. ACUTE BACTERIAL MENINGITIS AS SEEN IN CHILDREN OF EASTERN SAUDI ARABIA. CLIN. PEDIAT. (PHILA.) 5: 437-438, (Jul.), 1966.

In a survey of all the children under 13 years of age admitted to the Center between the years 1956 and 1964 the age distribution, symptoms, and physical findings were discussed.

ETIOLOGIC AGENTS:
- Meningococcus
- Pneumococcus
- Staphylococcus
- Hemophilus influenzae
- Streptococcus
- Escherichia coli
- Salmonella
- Pseudomonas
- Pseudomonas and Escherichia coli
- Undetermined

SEQUELAE:
Permanent residual neurologic defects, severe brain damage, convulsions, impaired vision, hydrocephalus.

RESEARCH CENTER:
Dhahran Health Center of the Arabian American Oil Company.

REFERENCES:
3

43. MCNIEL, J. R. MENINGITIS IN EASTERN SAUDI ARABIA. CHILDHOOD MENINGITIS. MIDDLE EAST MED. J. 2: 13-17, (Jan.-Apr.), 1965.

A review of all patients under ten years of age treated for meningitis between 1956 and 1963 discussed the prominent symptoms, physical and spinal fluid findings, and sequelae of the illness.

ETIOLOGIC AGENTS:
- Pneumococcus
- Meningococcus
- Staphylococcus
- Streptococcus
- Hemophilus influenzae
- Escherichia coli
- Escherichia coli and pseudomonas
- Salmonella
- Not specified
- Not determined

SEQUELAE:
Death, transient paresis of left arm, convulsions, optic atrophy, spastic transient visual impairment, hydrocephalus, subdural effusions.

RESEARCH CENTER:
Dhahran.

REFERENCES:
7

44. MATHIES, A. W., JR., HODGMAN, J., AND IVLER, D. HEMOPHILUS INFLUENZAE MENINGITIS IN A PREMATURE INFANT. PEDIATRICS 35: 791-792, (May), 1965.

A case study of a three day old infant who died from meningitis due to H. influenzae was presented. Failure of the mother to experience the customary immunizing infection and thus the lack of protection in the infant seemed to be important factors in the illness.

ETIOLOGIC AGENTS:
- Hemophilus influenzae

SEQUELAE:
Death.

RESEARCH CENTER:
Premature Nursery Service, Los Angeles County General Hospital, and Department of Pediatrics, University of Southern California School of Medicine.
REFERENCES:
10

45. MATTHEWS, E. C. SUBDURAL EFFUSIONS COMPLICATING BACTERIAL MENINGITIS. A PEDIATRIC REVIEW. OHIO MED. J. 50: 1154-1155, (Dec.), 1954.

In an analysis of subdural effusions which complicated meningitis, the pathogenesis, etiologic factors, characteristics, symptoms, and treatment of these effusions were discussed.

ETIOLOGIC AGENTS:
Hemophilus influenzae
Pneumococcus
Meningococcus
SEQUELAE:
Subdural effusions.
RESEARCH CENTER:
Department of Pediatrics, University of Cincinnati College of Medicine.
REFERENCES:
6

46. MELIGRANA, F., HAWKS, H., AND MAROTTA, T. HEMOPHILUS INFLUENZAE SEPTICEMIA WITH POLYARTHRITIS AND MENINGITIS IN AN ADULT. CANAD. MED. ASS. J. 89: 132-134, (Jul. 20), 1963.

A case report of a 65 year old woman was presented. Her progress was complicated by a super-imposed staphylococcus pneumonia with septicemia.

ETIOLOGIC AGENTS:
Hemophilus influenzae
Staphylococcus
SEQUELAE:
Death.
RESEARCH CENTER:
St. Michael's Hospital, Toronto.
REFERENCES:
12

47. MIDDELKAMP, J. N. BACTERIAL AND VIRAL MENINGITIS IN INFANTS AND CHILDREN. J. KENTUCKY MED. ASS. 61: 569-572, (Jul.), 1963.

In a review of the 465 patients treated for meningitis, the difficulty in diagnosing meningitis in children and the need for early and accurate treatment was presented. Detailed discussions of viral and bacterial meningitis were also included.

ETIOLOGIC AGENTS:
Hemophilus influenzae
Meningococcus
Pneumococcus
Mixed
Enteric bacilli
Streptococcus and Staphylococcus
Unknown
SEQUELAE:
Death.
RESEARCH CENTER:
Department of Pediatrics, Washington University School of Medicine and St. Louis Children's Hospital, St. Louis, Missouri.
REFERENCES:
5

48. NYHAN, W. L. AND RICHARDSON, F. COMPLICATIONS OF MENINGITIS. *ANN. REV. MED.* 14: 243-260, 1963.

A discussion of some of the problems associated with meningitis was presented. Included were discussions on mortality, complications (acute and chronic) and therapy.

ETIOLOGIC AGENTS:

Pneumococcus
Meningococcus
Hemophilus influenzae
Mycobacterium tuberculosis
Flavobacterium meningosepticum
Listeria monocytogenes
Salmonella
Leptospira canicola

SEQUELAE:

Death, hydrocephalus, deafness, blindness, mental deficiency, convulsions.

RESEARCH CENTER:

Department of Pediatrics, The Johns Hopkins University
School of Medicine, Baltimore, Maryland.

REFERENCES:

116

49. PAUL, S. S. PYOGENIC MENINGITIS IN CHILDREN. A STUDY OF 48 CASES. *INDIAN J. CHILD HEALTH* 12: 98-103, (Feb.), 1963.

A review of 48 cases of pyogenic meningitis which occurred between 1956 and 1959 was presented. The majority of patients were under three years of age, had respiratory infections before entering the hospital and came from low standard living conditions. The treatment was discussed for each organism.

ETIOLOGIC AGENTS:

Streptococcus pneumoniae
Hemophilus influenzae
Neisseria meningitidis
Salmonella
Streptococcus haemolyticus
Unidentified

SEQUELAE

Death.

RESEARCH CENTER:

Kalavti Saran Children's Hospital, Lady Hardinge Medical
College, New Delhi.

REFERENCES:

25

50. PLATOU, R. V., RINKER, A., AND DERRICK, J. ACUTE SUBDURAL EFFUSIONS AND LATE SEQUELAE OF MENINGITIS. *PEDIATRICS* 23: 962-971, (May), 1959.

In a retrospective study of 343 patients under the age of three years, the frequency and severity of neurologic sequelae were positively associated with the presence of early subdural collections which were most common in the youngest patients.

ETIOLOGIC AGENTS:

Hemophilus influenzae
Pneumococcus
Meningococcus
Unknown
"Others"

SEQUELAE:

Death, subdural effusions, behavioral disturbances, emotional instability, poor weight or height gains, palsies of the extra-ocular muscles, hearing defects, mild monoplegia, hemiparesis, severe mental retardation, serious convulsive disorders.

RESEARCH CENTER:
Department of Pediatrics, Tulane Medical School and The Charity Hospital of Louisiana.
REFERENCES:
15

51. PRATHER, G. W. AND SMITH M. H. D. CHLORAMPHENICOL IN THE TREATMENT OF HEMOPHILUS INFLUENZAE MENINGITIS. J.A.M.A. 143: 1405-1406, (Aug. 19), 1950.

A study was presented of 15 patients treated for meningitis between 1949 and 1950. The treatment and results were discussed for all the patients.

ETIOLOGIC AGENTS:
Hemophilus influenzae
SEQUELAE:
Transient leg and arm weakness.
RESEARCH CENTER:
Department of Pediatrics, Tulane Medical School and The Charity Hospital of Louisiana at New Orleans.
REFERENCES:
11

52. PROSNITZ, L. R. DEAFNESS FOLLOWING HEMOPHILUS INFLUENZAE MENINGITIS. ARCH. INTERN. MED. (CHICAGO) 113: 415-417, (Mar.), 1964.

A retrospective case study concerning the occurrence of bilateral permanent deafness as a result of meningitis due to Hemophilus influenzae was presented.

ETIOLOGIC AGENTS:
Hemophilus influenzae
SEQUELAE:
Bilateral permanent deafness.
RESEARCH CENTER:
Medical Service, Mary Hitchcock Memorial Hospital.
REFERENCES:
13

53. RANTASALO, I. AND KAUHTIO, J. ACUTE BACTERIAL MENINGITIS IN CHILDREN. II. SOME ASPECTS OF 257 CASES ADMITTED TO CHILDREN'S HOSPITAL, UNIVERSITY OF HELSINKI, IN 1946-1955. ANN. PAEDIAT. FENN. 4: 80-91, 1958.

In a review of 257 cases of acute bacterial meningitis those factors important in determining the outcome of the illness were reported to be age of the patient, season, duration of illness before admission to the hospital, occurrence of convulsions and unconsciousness before admission, cell-count of the cerebrospinal fluid, cutaneous hemorrhages.

ETIOLOGIC AGENTS:
Neisseria meningitidis
Streptococcus pneumoniae
Hemophilus influenzae
Unknown
"Others"
SEQUELAE:
Death.
RESEARCH CENTER:
Children's Hospital, University of Helsinki.
REFERENCES:
1

54. RHOADS, P. S. CLINICAL ANALYSIS OF 550 CASES OF BACTERIAL MENINGITIS. DIAGNOSTIC FEATURES AND VARIOUS METHODS OF TREAT-

MENT. AM. PRACT. 1: 305-314, (Feb.), 1947.

In a study of 550 consecutive cases of bacterial meningitis admitted to Cook County Contagious Hospital a discussion was presented of the incidence of the various types of meningitis and the ways in which the etiology of purulent meningitis was correctly diagnosed. A chart was given, containing the methods of treatment recommended for each type of meningitis and also for patients admitted in shock.

ETIOLOGIC AGENTS:
Meningococcus
Pneumococcus
Hemophilus influenzae
Tubercle bacillus
Streptococcus
Streptococcus and meningococcus
Bacillus coli
Staphylococcus

SEQUELAE:
Death.

RESEARCH CENTER:
Cook County Contagious Hospital.

REFERENCES:
13

55. SCHIAVONE, D. J. AND ROBBO, S. D. ANAEMIA ASSOCIATED WITH HAEMOPHILUS INFLUENZAE MENINGITIS. LANCET 2: 696-698, (Oct. 3), 1953.

In a study of 196 cases anaemia was found most often in the severer forms of meningitis. Neither age nor blood-group of the patient had any effect on the frequency of the occurrence of anaemia.

ETIOLOGIC AGENTS:
Haemophilus influenzae
Meningococcus

SEQUELAE:
Death.

RESEARCH CENTER:
University of Melbourne.

REFERENCES:
8

56. SCHOENBACH, E. G., SPENCER, H. C. AND MONNIER, J. TREATMENT OF HEMOPHILUS INFLUENZAE MENINGITIS WITH AUREOMYCIN AND CHLORAMPHENICOL. EXPERIENCE IN 30 CONSECUTIVE CASES. AM. J. MED. 12: 263-276, (Mar.), 1952.

In a comparison of patients treated with aureomycin and patients treated with chloramphenicol, those treated with the latter showed a lower fatality rate and a lower percentage of residua. The difference in the ages of the two groups limited the prediction of the most effective treatment.

ETIOLOGIC AGENTS:
Hemophilus influenzae

SEQUELAE:
Death, subdural effusions, retardation, hemiparesis, hearing loss, residual neurologic disturbances.

RESEARCH CENTER:
The Department of Preventive Medicine and Pediatrics, The Johns Hopkins University School of Medicine, The Harriet Lane Home, The Johns Hopkins Hospital, Baltimore, Maryland.

REFERENCES:
15

57. SHAW, E. B. AND BRUYN, H. B. STREPTOMYCIN IN THERAPY OF HEMOPHILUS INFLUENZAE MENINGITIS. J. PEDIAT. 56: 253-258, (Feb.), 1960.

A study of 132 patients treated between January 1949 and 1959 discussed the use of streptomycin and sulfadiazine in the treatment of Hemophilus influenzae meningitis. The effectiveness of chloramphenicol and tetracycline were also considered. The relationship of subdural effusion deaths to age of onset and length of illness before admission to a hospital was given.

ETIOLOGIC AGENTS:

Hemophilus influenzae
Pneumococcus
Meningococcus

SEQUELAE:

Death, subdural effusion, mental retardation, impaired hearing and vision, herpes simplex eruptions.

RESEARCH CENTER:

The Department of Pediatrics, University of California School of Medicine, The San Francisco General Hospital, and The Children's Hospital, San Francisco.

REFERENCES:

11

58. SMITH, E. S. PURULENT MENINGITIS IN INFANTS AND CHILDREN. REVIEW OF 409 CASES. J. PEDIAT. 45: 425-426, (Oct.), 1954.

The 409 patients admitted for treatment of purulent meningitis between 1944 and 1953 were studied in regards to the following factors: the age incidence of meningitis, the incidence of the various bacterial agents, the mortality, and the complications resulting from the illness.

ETIOLOGIC AGENTS:

Hemophilus influenzae
Neisseria meningitidis
Mycobacterium tuberculosis
Diplococcus pneumoniae
Escherichia coli
"Others"

SEQUELAE:

Death, retardation, convulsions, hydrocephalus, blindness, deafness, chronic meningitis, quadriplegia, aphasia, behavior problems, precocious puberty, poor vision, spasticity, hemiparesis.

RESEARCH CENTER:

The Department of Pathology, Children's Hospital, Los Angeles and the School of Medicine, University of Southern California.

REFERENCES:

20

59. SMITH, J. F. AND LANDING, B. H. MECHANISMS OF BRAIN DAMAGE IN HEMOPHILUS INFLUENZAE MENINGITIS. J. NEUROPATH. EXP. NEUROL. 19: 248-265, (Apr.), 1960.

A detailed analysis was presented of 34 fatal cases of H. influenzae meningitis which occurred between 1932 and 1958. The purpose of the study was to determine how this agent caused permanent brain damage. There were four groups by age: under six months, six months to one year, one to two years, and over two years. Case studies and post mortem findings were given for each group.

ETIOLOGIC AGENTS:

Hemophilus influenzae

SEQUELAE:

Death.

RESEARCH CENTER:
Departments of Pathology, Neurosurgery, and Pediatrics of The Cincinnati General Hospital, The Cincinnati Children's Hospital, and The University of Cincinnati College of Medicine.
REFERENCES:
12

60. SMITH, M. H. D. ACUTE BACTERIAL MENINGITIS. *PEDIATRICS* 17: 248-277, (Feb.), 1956.

In this review article, all aspects of acute bacterial meningitis of children were discussed, such as etiology, age, seasonal incidence, clinical manifestation, diagnosis, treatment, prognosis, and complications encountered during meningitis. Correct diagnosis and early treatment were stressed.

ETIOLOGIC AGENTS:
Hemophilus influenzae
Neisseria meningitidis
Diplococcus pneumoniae
Pseudomonas aeruginosa
Escherichia coli
Unknown
SEQUELAE:
Sixth, seventh, and eighth nerve paralysis, subdural effusion, hydrocephalus.
RESEARCH CENTER:
Tulane University School of Medicine and Charity Hospital, New Orleans, Louisiana.
REFERENCES:
90

61. SMITH, M. H. D. SUBDURAL LESIONS IN CHILDHOOD, WITH SPECIAL REFERENCE TO INFECTIOUS PROCESSES. *ADVANCES PEDIAT.* 8: 165-189, 1956.

A description of all types of subdural lesions in childhood was presented. The age of the patients, etiology of antecedent meningitis, indications for subdural tap, characteristics of subdural fluid, and treatment were discussed.

ETIOLOGIC AGENTS:
Hemophilus influenzae
Diplococcus pneumoniae
Neisseria meningitidis
Tubercle bacillus
SEQUELAE:
Death, subdural effusion, developmental retardation, blindness, dysphasia, right hemiparesis, convulsions, coma.
RESEARCH CENTER:
Tulane University School of Medicine and The Charity Hospital, New Orleans, Louisiana.
REFERENCES:
59

62. SMITH, M. H. D., DORMONT, R. E., AND PRATHER, G. W. SUBDURAL EFFUSIONS COMPLICATING BACTERIAL MENINGITIS. *PEDIATRICS* 7: 34-43, (Jan.), 1951.

A study was presented of 43 patients under two years of age who were treated for bacterial meningitis during an 11 month period. Indications and techniques of subdural taps were discussed and the general clinical features were presented.

ETIOLOGIC AGENTS:
Hemophilus influenzae
Diplococcus pneumoniae

Pseudomonas aeruginosa
Neisseria meningitidis
Salmonella
Paracolon bacillus
"Others"

SEQUELAE:
Subdural effusions.

RESEARCH CENTER:
Department of Pediatrics, Tulane University School of Medicine, Louisiana State University School of Medicine and The Charity Hospital of Louisiana, New Orleans, Louisiana.

REFERENCES:
23

63. SNYDER, S. N. AND BRUNJES, S. HEMOPHILUS INFLUENZAE MENINGITIS IN ADULTS. REVIEW OF THE LITERATURE AND REPORT OF 18 CASES. AMER. J. MED. SCI. 250: 658-667, (Dec.), 1965.

The occurrence of H. influenzae in adults was discussed. A majority of these patients had a predisposing factor.

ETIOLOGIC AGENTS:
Hemophilus influenzae

SEQUELAE:
Death, slight ataxia and tinnitus.

RESEARCH CENTER:
The Communicable Disease Service of The Los Angeles County Hospital, Los Angeles, California.

REFERENCES:
56

64. SPITZ, E., POLLAK, A., AND ANGRIST, A. SUBDURAL SUPPURATION ORIGINATING IN PURULENT LEPTOMENINGITIS. ARCH. NEUROL. PSYCHIAT. 53: 144-149, (Feb.), 1945.

In a discussion of subdural suppuration as a complication of purulent leptomeningitis, alternate ways in which infection spread from the subarachnoid to the subdural space were discussed. There was evidence to suggest that suppuration was the cause of postmeningotic epilepsy.

ETIOLOGIC AGENTS:
Pneumococcus
Hemophilus influenzae
Streptococcus
Staphylococcus
Bacillus pyocyaneus

SEQUELAE:
Death, hydrocephalus, epilepsy.

RESEARCH CENTER:
Department of Pathology, Queens General Hospital, New York.

REFERENCES:
4

65. STEVENS, H. AND WILLIAMS, J. M. SUBDURAL EFFUSIONS IN INFANCY. MED. ANN. D. C. 22: 169-174, (Apr.), 1953.

This article discussed the increasing numbers of subdural effusions and neurologic sequelae among survivors of bacterial meningitis today. The symptoms for subdural effusions and the cases in which membranes must be removed were included.

ETIOLOGIC AGENTS:
Homophilus influenzae
Diplococcus pneumoniae
Neisseria meningococcus
Hemophilus influenzae and Diplococcus pneumoniae
Undetermined

SEQUELAE:
Mental defectiveness, subdural effusions.
RESEARCH CENTER:
The Neurological and Neurosurgical Services, Children's Hospital, Washington, D. C.
REFERENCES:
24

66. SWARTZ, M. N. AND DODGE, P. R. BACTERIAL MENINGITIS--A REVIEW OF SELECTED ASPECTS. I. GENERAL CLINICAL FEATURES. SPECIAL PROBLEMS AND UNUSUAL MENINGEAL REACTIONS MIMICKING BACTERIAL MENINGITIS. NEW ENG. J. MED. 272: 725-731 contd., (Apr. 8), 1965.

A review of 207 patients treated at Massachusetts General Hospital between the years 1956 and 1962 was presented. The bacterial etiology, clinical features, frequency of various pathogens, and a review of neonatal meningitis were included.

ETIOLOGIC AGENTS:
Diplococcus pneumoniae
Hemophilus influenzae
Neisseria meningitidis
Streptococcus
Escherichia coli
Staphylococcus aureus
Pseudomonas aeruginosa
Pasturella multocida
Proteus
Listeria monocytogenes
Unknown
SEQUELAE:
Death.
RESEARCH CENTER:
The Department of Medicine and Neurology, Harvard Medical School, and the Medical (Infectious Disease Unit) Neurological and Children's Services and the Joseph P. Kennedy, Jr. Laboratories of the Massachusetts General Hospital.
REFERENCES:
47

67. SWARTZ, M. N. AND DODGE, P. R. BACTERIAL MENINGITIS--A REVIEW OF SELECTED ASPECTS. I. GENERAL CLINICAL FEATURES, SPECIAL PROBLEMS AND UNUSUAL MENINGEAL REACTIONS MIMICKING BACTERIAL MENINGITIS. NEW ENG. J. MED. 272: 779-787 contd., (Apr. 15), 1965.

A study of 207 patients treated between 1956 and 1962 discussed predisposing factors, ancillary cultures, cerebrospinal fluid findings, and antibacterial treatment.

ETIOLOGIC AGENTS:
Diplococcus pneumoniae
Hemophilus influenzae
Neisseria meningitidis
Streptococcus
Escherichia coli
Staphylococcus aureus
Pseudomonas aeruginosa
Clostridium perfringens
Proteus
Listeria monocytogenes
Unknown
SEQUELAE:
Death.
RESEARCH CENTER:
The Department of Medicine and Neurology, Harvard Medical School, and the Medical (Infectious Disease Unit), Neuro-

logical and Children's Services and the Joseph P. Kennedy, Jr., Laboratories of the Massachusetts General Hospital.
REFERENCES:
32

68. SWARTZ, M. N. AND DODGE, P. R. BACTERIAL MENINGITIS--A REVIEW OF SELECTED ASPECTS. I. GENERAL CLINICAL FEATURES, SPECIAL PROBLEMS AND UNUSUAL MENINGEAL REACTIONS MIMICKING BACTERIAL MENINGITIS. NEW ENG. J. MED. 272: 842-848 contd., (Apr. 22), 1965.

A study of 207 patients treated between 1956 and 1962 discussed the organisms and special features of recurrent meningitis.

ETIOLOGIC AGENTS:
Diplococcus pneumoniae
Hemophilus influenzae
Neisseria meningitidis
Streptococcus
Escherichia coli
Staphylococcus aureus
Pseudomonas aeruginosa
Pasturella multocida
Clostridium perfringens
Proteus
Listeria monocytogenes
Unknown

SEQUELAE:
Death.

RESEARCH CENTER:
The Department of Medicine and Neurology, Harvard Medical School, and the Medical (Infectious Disease Unit), Neurological and Children's Services and the Joseph P. Kennedy, Jr., Laboratories of the Massachusetts General Hospital.

REFERENCES:
32

69. SWARTZ, M. N. AND DODGE, P. R. BACTERIAL MENINGITIS--A REVIEW OF SELECTED ASPECTS. I. GENERAL CLINICAL FEATURES, SPECIAL PROBLEMS AND UNUSUAL MENINGEAL REACTIONS MIMICKING BACTERIAL MENINGITIS. NEW ENG. J. MED. 272: 898-902 contd., (Apr. 29), 1965.

A study of 207 patients treated between 1956 and 1962 discussed Behcet's syndrome, chemical and neoplastic meningitis complicated by epidermoid cysts.

ETIOLOGIC AGENTS:
Diplococcus pneumoniae
Hemophilus influenzae
Neisseria meningitidis
Streptococcus
Escherichia coli
Staphylococcus aureus
Psuedomonas aeruginosa
Pasturella multocide
Clostridium perfringens
Proteus
Listeria monocytogenes
Unknown

SEQUELAE:
Death.

RESEARCH CENTER:
The Department of Medicine and Neurology, Harvard Medical School, and the Medical (Infectious Disease Unit), Neurological and Children's Services and the Joseph P. Kennedy, Jr., Laboratories of the Massachusetts General Hospital.

REFERENCES:
30

70. WAGNER, M. G. SEQUELAE OF BACTERIAL MENINGITIS IN INFANTS. CALIF. MED. 101: 348-351, (Nov.), 1964.

In a prospective study of ten children under two years of age who were treated for purulent meningitis, the value of developmental testing was discussed and the possible relationship between subdural taps and intelligence quotient was considered.

ETIOLOGIC AGENTS:
Hemophilus influenzae
Streptococcus
Pneumococcus
Unidentified

SEQUELAE:
Behavior problems, abnormal nonfocal electroencephalogram, slow development, seizures, retardation, neurological deficit.

RESEARCH CENTER:
The School of Medicine (Pediatrics) and the School of Public Health, University of California Center for Health Sciences, Los Angeles.

REFERENCES:
17

71. WILLIAMS, J. M. AND STEVENS, H. POSTMENINGITIC SUBDURAL EFFUSIONS. J. INT. COLL. SURG. 27: 590-594, (May), 1957.

A study was presented which analyzed the cause, the appearance, and the effect of subdural effusions.

ETIOLOGIC AGENTS:
Diplococcus pneumoniae
Meningococcus
Hemophilus influenzae

SEQUELAE:
Subdural effusion.

RESEARCH CENTER:
Department of Neurology and Neurosurgery, Children's Hospital, Washington, D. C.

REFERENCES:
30

72. YU, J. S. AND GRAUAUG, A. PURULENT MENINGITIS IN THE NEONATAL PERIOD. ARCH. DIS. CHILD. 38: 391-396, (Aug.), 1963.

A review of 47 infants who were treated for meningitis between December 1951 and July 1953 was presented. The therapy and factors influencing the mortality and complication rate were discussed.

ETIOLOGIC AGENTS:
Escherichia coli
Paracolon bacilli
Pseudomonas
Proteus
Streptococcus faecalis
Staphylococcus aureus
Streptococcus haemolyticus
Pneumococcus
Hemophilus influenzae
Unidentified

SEQUELAE:
Death, hydrocephaly, subdural effusions.

RESEARCH CENTER:
Institute of Child Health, Royal Alexandra Hospital for Children, Sydney, N.S.W., Australia.

REFERENCES:
13

SEQUELAE INDEX

Arthritis 5.

Auditory impairment
  deafness 3, 4, 5, 7, 8, 9, 11, 13, 14, 17, 18, 19, 20, 24, 25, 26, 27, 31, 34, 35, 36, 37, 48, 52, 56, 58.
  hearing defects 11, 50, 57.
  tinnitus 63.

Behavior disturbance 7, 12, 18, 19, 20, 24, 26, 36, 37, 50, 58, 70.

Brain damage 1, 2, 6, 12, 29, 70.
  agraphia 13.
  alexia 13.
  aphasia 13, 18, 58.
  cerebellar herniation 14.
  cerebral atrophy 39.
  dysphasia 14, 61.
  hydrocephalus 6, 7, 10, 11, 13, 18, 19, 20, 22, 25, 26, 27, 38, 39, 42, 43, 48, 58, 60, 64, 72.
  mental impairment 4.
  mental regression 18.

Coma 61.

Convulsions 9, 13, 17, 20, 26, 38, 43, 44, 48, 50, 58, 61.
  febrile 26.
  seizures, grand mal 26.
  seizures, unspecified 15, 22, 24, 70.

Death 2, 3, 4, 7, 8, 10, 11, 13, 14, 15, 16, 17, 19, 21, 22, 23, 26, 29, 32, 33, 35, 36, 37, 38, 41, 43, 44, 46, 47, 48, 49, 50, 53, 54, 55, 56, 57, 58, 59, 61, 63, 64, 66, 67, 68, 69, 72.

Dementia 9.

Developmental retardation 7, 18, 19, 50, 61, 70.

Dizziness 9.

Emotional problems 37, 50.

Epilepsy 19, 20, 27, 33, 64.

Extremity, defect in
  leg and arm weakness 51.
  spasticity of arms and legs 13.

Focal necrosis 6.

Headache 9.

Intelligence impairment 19, 26.

Mental Retardation 11, 17, 18, 20, 22, 24, 25, 26, 27, 28, 36, 38, 39, 48, 50, 56, 57, 58, 65, 70.

Mongolism 26.

Motor impairment 17.
  palsy 9, 17, 31.

Muscle weakness
  arms and legs 11.
  facial 24.
  hypotonia 39.

Neurologic disturbances 15, 29, 33, 36, 42, 56, 70.
  ataxia 13, 25, 26, 63.
  cerebral palsy 36.
  eighth nerve paralysis 60.
  extra-ocular muscle palsy 50.
  facial paralysis 18, 31.
  hemiparesis 7, 9, 14, 22, 26, 50, 56, 58, 61.
  hemiplegia 11, 19, 24, 25, 35.
  monoplegia 50.
  motor paralysis 17, 31.
  ocular paralysis 31.
  paraplegia 35.
  quadriplegia 58.
  seventh nerve paralysis 60.
  sixth nerve paralysis 18, 60.
  spacticity 13, 39, 58.
  triplegia 14.

Poor concentration 19.

Psychic disturbances 16.

Puberty
  precocious 36, 58.

Reflex change 7.

Skin disturbances
    Herpes simplex eruptions 56.

Speech impairment 24.
    defect in speech 36.
    dysphasia 14, 61.
    loss of speech 34.

Subdural effusions 6, 9, 10, 15, 20, 27, 30, 43, 45, 50, 56, 57, 60, 61, 62, 65, 71, 72.

Visual impairment
    amplitude asymmetry 7.
    blindness 1, 41, 11, 25, 38, 39, 48, 58, 61.
    defective vision 7, 17, 20, 42, 43, 57, 58.
    ocular paralysis 31.
    optic atrophy 43.
    palsies of the extra-ocular muscles 50.
    strabismus 17.
    uveitis 5.

Withdrawal 25.

ETIOLOGIC AGENT INDEX

Actinomyces 5.

Aerobacter aerogenes 26.

Bacillus evanidus 5.

Clostridium perfringers 14, 67, 68, 69.

Diplococcus pneumonia 1, 4, 5, 6, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 24, 25, 26, 26, 28, 29, 31, 32, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 45, 47, 48, 49, 50, 53, 54, 57, 58, 60, 61, 62, 64, 65, 66, 67, 68, 69, 70, 71, 72.

Diptheroid 9.

Escherichia coli 5, 9, 10, 13, 14, 18, 21, 26, 31, 36, 38, 42, 43, 54, 58, 60, 66, 67, 68, 69, 72.

Flavobacterium meningosepticum 48.

Klebsiella pneumoniae 4, 5.

Listeria
  monocytogenes 14, 48, 66, 67, 68, 69.
  unspecified 5, 38.

Micrococcus tetragenus 5.

Mycobacterium tuberculosis 21, 28, 40, 48, 54, 58, 61.

Neisseria
  catarrhalis 5.
  meningitidis 4, 5, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 24, 25, 26, 27, 28, 29, 30, 31, 32, 34, 35, 36, 37, 38, 40, 41, 42, 43, 45, 47, 48, 49, 50, 53, 54, 55, 57, 58, 60, 61, 62, 65, 66, 67, 68, 69, 71.
  pharyngis 5.

Paracolon bacillus 9, 10, 19, 47, 62, 72.

Pasturella multocide 14, 66, 68, 69.

Pseudomonas
    aeruginosa 5, 14, 26, 60, 62, 66, 67, 68, 69.
    unspecified 10, 18, 36, 42, 64, 72.

Salmonella
    typhosa 5.
    unspecified 5, 10, 18, 36, 42, 43, 48, 49, 62.

Staphylococcus
    albus 38.
    aureus 2, 14, 16, 23, 31, 38, 66, 67, 68, 69, 72.
    pyogenes 17.
    unspecified 4, 5, 9, 10, 17, 26, 28, 33, 36, 40, 41, 42, 43, 46, 54, 64.

Streptococcus
    faecalis 72.
    pyogenes 26, 49, 72.
    unspecified 4, 5, 9, 10, 13, 14, 16, 20, 28, 31, 33, 34, 36, 37, 41, 42, 43, 54, 64, 66, 67, 68, 69, 70.

Mixed
    Hemophilus influenzae and Diplococcus pneumoniae 40, 65.
    Pseudomonas and *Escherichia coli* 42, 43.
    Streptococcus and *Meningococcus* 54.
    Streotococcus and Staphylococcus 47.
    Unspecified 9, 19, 26, 41, 47.

Others 4, 16, 27, 32, 33, 35, 50, 53, 58, 62.

Unknown 9, 10, 14, 16, 17, 18, 19, 21, 23, 24, 25, 28, 29, 30, 31, 35, 37, 39, 41, 43, 47, 49, 50, 53, 54, 60, 65, 66, 67, 68, 69, 70, 72.

APPENDIX B.

DATA COLLECTION FORMS

THE UNIVERSITY OF TEXAS
SOUTHWESTERN
MEDICAL SCHOOL AT DALLAS

DEPARTMENT OF PEDIATRICS

5323 HARRY HINES BLVD.
DALLAS, TEXAS 75235

March 24, 1971

Dear Parent:

We are working with your schools in a study of the health of school children. To do this we need some information which only you can give us. Your cooperation is voluntary and your answers will be kept completely confidential.

Please fill in the blanks below.

Student's name____

Has your child ever had: (Circle yes or no)

Convulsions (fits) Yes No

Meningitis Yes No

Encephalitis ("brain fever") Yes No

Head injury causing unconsciousness Yes No

What is the occupation of the head of household?_______________

What is the highest grade in school that the head of household completed?____________________________________

Thank you very much for your help. Please return this sheet in the stamped, self-addressed envelope.

Sincerely,

John D. Nelson, M. D.
Professor of Pediatrics

JDN:mn

THE UNIVERSITY OF TEXAS
SOUTHWESTERN
MEDICAL SCHOOL AT DALLAS

DEPARTMENT OF PEDIATRICS

5323 HARRY HINES BLVD.
DALLAS, TEXAS 75235

24 de Marzo de 1971

Estimados Padres:

Estamos trabajando en un proyecto de estudio de la salud escolar. Para esto, necesitamos detalles que sólo usted puede entregarnos. Su cooperación es voluntaria y las respuestas serán confidenciales.

Por favor rellene los espacios que correspondan.

Nombre del alumno____

Ha tenido su hijo alguna vez: (Circule si o no)

¿Convulciones? (ataques)	Si	No
¿Meningitis?	Si	No
¿Encefalitis?	Si	No
¿Golpes en la cabeza con inconciencia?	Si	No

¿Ocupacion del jefe de la familia?____________________________

¿Ultimo grado de colegio en que estuvo el jefe de la familia?__________

Desde ya muchas gracias por su ayuda. Ruego enviar esta hoja en el sobre que le adjunto.

Sinceramente,

John D. Nelson, M. D.
Professor of Pediatrics

JDN:mn

DATA COLLECTION FORM

SCHOOL ADJUSTMENT - GENERAL INFORMATION

________________ (1-7) ID Number

________________ (11) Enrolled in grade
1. K 2. 1st 3. 2nd 4. 3rd 5. Spec.Ed. 6. Other

________________ (12) Attended kindergarten
1. yes 2. no 3. other

________________ (13) Grade repeated
1. K 2. 1st 3. 2nd 4. 3rd 5. None

________________ (14) Scholastic Evaluation
1. E 2. G. 3. S 4. U 5. None

________________ (15-16) Principal area of Academic Difficulty
1. Reading 2. Spelling 3. Math 4. Soc. Stud. 5. Writing 6. Reading and Math 7. Reading and Spelling 8. Reading and Soc. Stud. 9. Reading and Writing 10. Other 11. None 12. Writing and Math 13. All areas 14. Math and Soc. Stud.

________________ (17-20) IQ Score
1. IQ Score, Individual
2. IQ Score, Group
3. Not available

TEACHER APPRAISAL: Items 1-44 represent the teacher's evaluation of the child. For these items please check the first blank if it seems true, the second blank if it doesn't seem true and the third blank if you don't know.

__,__,__1. Does teacher have regular contact with the parents?

__,__,__2. In teacher's opinion this family has too high expectations for the child.

__,__,__3. In teacher's opinion this family's expectations are commensurate with the child's ability.

__,__,__4. In teacher's opinion the parents exert too much pressure for academic achievement.

__,__,__5. In teacher's opinion the parents tend to over-organize the child's time.

__,__,__6. In teacher's opinion the parents tend to over-indulge the child.

__,__,__7. In teacher's opinion the parents have a wholesome attitude toward the child.

__,__,__8. Poor general coordination

__,__,__9. Unsteady gait (when walking or running)

__,__,__10. Is behavior problem at school

__,__,__11. Reads below expected grade level

__,__,__12. Poor acceptance among peer group

__,__,__13. Has poor handwriting

__,__,__14. Has a poor self-concept

__,__,__15. Is not dependable

__,__,__16. Is careless with school work

__,__,__17. Is destructive with school materials

__,__,__18. Academic achievement is very uneven

__,__,__19. Is very restless

__,__,__20. Has tics or jerky movements while working

__,__,__21. Manifests little or no originality

__,__,__22. Is sluggish and sedentary

__,__,__23. Dislikes playground activities

__,__,__24. Is physically underdeveloped

__,__,__25. Is a chronic worrier

__,__,__26. Is shy and withdrawn with adults

__,__,__27. Dislikes competition in any form

__,__,__28. Is very aggressive

__,__,__29. Is physically attractive

__,__,__30. Is easily angered

__,__,__31. Seldom or never contributes voluntarily to work

__,__,__32. Dislikes school

__,__,__33. Is uneasy during unstructured activity

__,__,__34. Is an under-achiever

__,__,__35. Cries easily

__,__,__36. Prefers younger companions

__,__,__37. Has difficulty orienting to sound

__,__,__38. Is a chronic absentee

__,__,__39. Is frequently sleepy or lethargic

__,__,__40. Has frequent sleepy spells of inattention or staring into space

__,__,__41. Complains of frequent headaches

__,__,__42. Has frequent skin problem(s) (rashes, etc.)

__,__,__43. Is overweight

__,__,__44. Has frequent problems with upset stomach or vomiting

Appendix C.

EXPLANATORY LETTERS

INTRODUCTORY LETTER
FROM DR. HASSINGER TO ORLEANS PARISH PRINCIPALS

Dr. Mark A. Belsey, Acting Chairman of the Department of Epidemiology, Tulane School of Public Health and Tropical Medicine, is conducting a study of the school adjustment of post-meningitic children. This study, hopefully, will identify the type of disorder a post-meningitic child is apt to have, with the aim of developing a pre-school intervention program.

The cooperation of the school system with Dr. Belsey in this study has been approved by Dr. Alton Cowan, Superintendent, and Dr. Julianna Boudreaux, Assistant Superintendent in charge of the Division of Pupil Personnel.

A student in your school has been identified as having had H influenzae meningitis during 1963 or 1964.

The name of the child is

Name	Grade	Date of Birth

The study will attempt to assess the school performance and behavior of these students against matched controls.

Two medical students (Miss Ann Ferguson and Mr. Barry Self) will be assisting Dr. Belsey with this study. I am requesting your cooperation with them when they contact you regarding this study. Appropriate safeguards for confidentiality of the records and the opinion of the child's teacher will be maintained.

If you have any questions concerning this study, please contact me.

Sincerely,

Gene C. Hassinger, M.D.
Medical Director

GCH:el
cc: Dr. Julianna Boudreaux
Dr. Mark Belsey

TULANE UNIVERSITY

School of Public Health and Tropical Medicine

NEW ORLEANS, LA. 70112

Department of Epidemiology and Biostatistics
1430 Tulane Avenue

November 1, 1971

Dear

The Department of Epidemiology and Biostatistics of Tulane University School of Public Health and Tropical Medicine is studying the school adjustment of children who have had meningitis during early childhood. This study is being carried out in cooperation with other medical schools and other school systems in southern cities. The New Orleans part of this study is under the direction of Dr. Mark Belsey, Acting Chairman of the Department of Epidemiology at Tulane. The aim of this study is to identify the areas of difficulty, if any, which these children have in their school adjustments. Then some means of overcoming these difficulties, possibly through some type of pre-school intervention, can be developed. I hope you will be able to help us in this study.

Dr. Gene Hassinger, Medical Director for the Orleans Parish School Board, has helped us to locate the children in Orleans Parish schools whom we would like to have in our study. You should have recently received a letter from Dr. Hassinger concerning this study. Through her assistance the following child(ren) have been identified as attending your school:

In order to obtain information on these children I have enclosed 2 forms which I hope you will be able to fill out on the child (or children) listed above. In addition, I would also like the same information on one other child in that child's class to use as a control. This other child (the control) may be selected from the class roll by merely taking the third child listed there who is of the same race and approximate age. If the third such child on the roll is the child whose name we sent, then take the fourth.

The first form, the Teacher Appraisal, should be completed by the child's classroom teacher. This may be either the child's current teacher or his teacher of last year. Please have the same teacher fill out the Teacher Appraisal for the child and his control, however.

The second form, School Adjustment - General Information, may be filled out from the child's school record. This form should also be completed for each child and for his control. Space is given for only two sets of test scores, but additional scores may be given on the back if you feel they would be of interest to us. It is important that the results of the same tests be given for both the child and his control in order that a comparison can be made.

If you have any questions concerning the study or the information we want, please feel free to call on me. I will be glad to answer any questions you may have.

Thank you for your cooperation in our study. We would be glad to send you a copy of the results of our study when it is completed.

Sincerely,

Barry Self
Tulane Medical Student
Department of Epidemiology
and Biostatistics

BS:lt

APPENDIX D.

CATEGORICAL DATA

CODE FOR CATEGORICAL DATA

	Field	Variable
Card I	(1)	1 - Dallas 2 - Tulane
	(2-3)	Pair Number
	(4)	1 - Index 2 - Control
	(5)	Card Number
	(6-7)	Grade in School
	(8-9)	Age in Years
	(10-11)	Age in Months
	(12)	1 - Male 2 - Female
	(13)	SES
	(14-15)	Length of Hospitalization
	(16)	Kindergarten 1 - yes 2 - no
	(17)	Number of Grades Repeated
	(18-19)	Years when Hospitalized
	(20-21)	Months when Hospitalized
	(22)	Scholastic E=5, G=4 S=3, U=2 None=1
	(23)	Race White 1, Balck 2, Indian 3, Spanish 4
	(24-25)	Area of Academic Difficulty
	(26-30)	Blank
	(31-74)	Teacher Ratings 1=yes 2=DK 3=No
Card II	(1-5)	Identification
	(6-19)	Metropolitan Readiness Test
	(20-21)	Blank
	(22-41)	California Achievement Test
	(42-55)	California Mental Maturity
	(56-57)	Error
	(58-67)	Comprehensive Test of Basic Skills
	(68-71)	IQ
Card III	(1-5)	Identification
	(6-8)	IQ
	(9-16)	Metropolitan Readiness Test
	(17-34)	Achievement Test

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10812                 15141514201616141615141111020710757021182722160070
10822                 17121615141423172217121107030720696826282827250068
1091213150406120454                                                 0100
1092214131315150979                                                 0100
11012                 17191918161714211517251311070740978520262121230085
11022                 26202422141722312422271111070810918330363032290083
1111205100611080343   121512112009042013111311130608006671          0081
1112209100816140461   162017151314211420162515151409709697          0097
1131204070001010013   110911090508060005091309130407506366          0065
1132205070001010015   140913130811100009122808120406809579          0079
1141211151216221137                                                 0100
1142212141415221097                                                 0100
1161207131016100258   131413171717171416151511090307307370          0070
1162205070408060434   141414161314182017151613130308208078          0078
1171207131108170359                                                 0100
1172207060815110249                                                 0100
11812                 111411110910110010111909110707207369          0069
11822                 151515141313191418152617100607909383          0083
11912                 293330283130314036333214191310310399          0103
11922                 364038342932362733343421211210712299          0115
1201205101014070350                                                 0100
1202203100912160454                                                 0100
1211205070000080323                     2210120607207771            0071
1212205070403050227                     2110100807308074            0074
1221207111016110762   161416131213172117151308150408005664          0064
1222209111116130969   181718151816202321182416170508609793          0093
1231207050303071136   101816141916202120171812160909407383          0083
1232204080003070325   170916141715161516162813120607709886          0086
1251203021307050542                                                 0100
1252203130916191176                                                 0100
1261203090009130438                                                 0100
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2622    061     56
1271205091115120437                                                   0100
1272207131015130462                                                   0100
1281201070102060017   14171515181714001415                            0100
1282205080100030118   13161314151414121314                            0100
1291207090305110035   211921232424242234251909110507407472            0072
1292205141011180766   301926243428283832292918171209810999            0104
1301209110405100241                                                   0100
1302204090409120442                                                   0100
13112                                    2217170309009391             0091
13122                                    2214180709209292             0092
1331205050210020226                      150913030750797413151813160074
1332210150716140971                      271419121030979934422932420101
1361207101007110752   231922141213201719172511150909109291            0091
1362210100804080050   151816181818231421182612210809809998            0098
1371209100815160462   342834303131293431323113201510810399            0106
1372207090616080450   312832232524233828292713121109009894            0094
13812                 16151513131312101213                            0100
13822                 22172019181916211719                            0100
1391211100510100652                                                   0100
1392214140815180574                                                   0100
1421211131216200895                                         17141117110100
1422210131016191179                                         24213629140100
1431209110713140559   121612130011150014122110130508208783            0083
1432213131016190576   201820211214181718172012120708908686            0086
1441205090615120351                                                   0100
1442205101415131171                                                   0100
1481210121416230580                      2417130408008680             0080
1482211131116210476                      2614141009809697             0097

     CARD ONE, TULANE, FOLLOWS:

201110409022 111501025203      12122212222222222222222222231222222222222232220100
201310408062 082503004213      23333332221222222212122222221112221221222223230100
2041101091020162001073100      12122232232222112222222222221222222222222222220100
2043105100610001000003201      33333332222223222222122232221222122222222222220100
2044105100610051102003201      23333332111223222111212231221113111132222222220100
2051105110310221002004211      22233312222222222222222222221222222222222222220100
2052105110310001000002200      32111122211222211112222222222122222222222222220100
2053104110210042103002213      12123211121212222222222232221322212232222222220100
2054104110210001000004204      22323232222222222222222222221222222222222222220100
2061105091120101002003103      12122211122212222112221212221222121222111111120100
2062105091120002000005211      22122212222222222222222222221222222222222222220100
2063105100120001000005211      12122222222222222222222222221222222222222222220100
2064105100120081003004206      22122212221222222221222222222122212222222222220100
207110209112 132500054213      22122212221211312111122221122211313132212222220100
207210408062    25    2211     23333332222222222222223222231222222111111111110100
207310308022 032500053209      12122232221221211112122221221221211222222222220100
207410308022    11    3209     22122232211221111112122222211112212222222222220100
2081101080310481100033201      12123212221222222212222122221222212222222222220100
2083102080910121100052213      12332232211122111112121122211112112222222222220100
2084102080910001000002213      12322212211122111112122232211112112322222222220100
2091104110410081202002213      23333332211211112211222221211111122322122220100
2092104110410001000005211      23333332222221222112222221212222222232222222220100
2093105110010031003003208      23333323222222222212222222221222221122222222220100
2094105110010001000003203      21222112222222222222222222221222221222222222220100
2111102090220001000005211      12122212222222222222222222221222222222222222220100
2112105100620001100003201      12122212221222221222222212222212221222222231230100
2113101100620342101023201      23322212321222212122222212122222111121133230100
2114102090220101100092213      13322222111111211112112222211122112222222221220100
2131105120210151004012206      13333122221211112112112232222113113332113323010
2133103110210142002001213      12133321211111111112121121311111312332222222220100
2134103110210001100001201      11222212221212222222222222222222212322222222220100
2141103110120111003022213      12222222211111111212112233311111213331112222230100
2142105110120001200002213      22322232211211112212122231122113211312312222220100
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2143105120320080103001203     23333332222222222222222222333212222222222233230100
2144105120320001200001214     23333332221122222222211213332212221132222233230100
2151105100020001000003107     222222211112121121111222222221212112222222222220100
2152105100020171001115111     12122212222222222222222221221222222222222222220100
2153105100920061002003201     223233122212223222221112212232223313221123230100
2154105100920001000003201     22123312221222222222122222223213322222222222220100
2171105100920051102001201     123321222211212112112222221122211211222222220100
2173103100720121102014203     233213133313331133333331333113333133313333330100
2174105100920001000003214     23333332221223222222222222221322212332222222220100
2181103101010121002063213     12222122212121221212222221211122121222222222220100
2182105101010001100004201     23323232211222222221222222221112212222222212220100
2183105110010071002003109     22122212221222222212222222211321112222222222220100
2184101110010002000003113     22221222221222222222122221222212212222222222220100
2201105090320071100093210     32322232221222222222122131221122221222222222220100
2202105100420001000003206     12122212221212222122122222221222221222222222220100
2203105090320001000003206     22322231211121112212122222221222212322222222220100
2204105100420141001025211     12122212222222222222222222221222222222222222220100
2211105100610231101043201     22333312221222222212222222121222212322222222220100
2212101100610002100003205     12222212221222222222222221222112221223222222220100
2213105090110121001003201     22222212211222222222222222212222122222222222220100
2214100090110000000000200     12122212221222122222122222221212212212222222220100
22211020906   132400092213    21223111211212111111121222212111112222112222220100
222210409012    15      3205  13233132222212212122222222221112222222222222220100
222310409011 472500102207     23323332221222222122112222221222212212113222220100
222410209062    25      3211  22123212222222222222222222322122222222222222220100
2231103090310142001013209     212133323112112121121123313213131133322123320100
2233104100010072001001207     23333332221222222222222222221222212222222222220100
2234104100010002000001201     22122212221222222222222222221222222222222222220100
224110408082 122500063207     22122213121122221211112212221112211122211122220100
224310308011 062500015207     22223222211212111112122212222122212222112212220100
224410308  1    15      1201  12122212222222222222222211212122222222222222220100
225110410041    23      3201  133333322112122221121221222221111211312123220100
225210410031    20     02210  12122212221222222222222222221222222222222222220100
225310410081 062003     3201  1212333221121211121222222222121111111322123110100
225410410081 152002004210     12122212222212222212222212222122222222222222220100
2653101071020112000022213     22222221111111111113113123332113211312132222220100
2654101071020002000003211     22122212222222222222222222212222222222222222220100

     CARD TWO, TULANE, FOLLOWS:

  2073205060404090 0
  20742050802071106
  2081205070710070441
  2083209080910090651
  2084207090907100751
  2203203080406050435 00
  2204207100815090453 00
  22132050810021102390 0
  22142070705081009460 0
  2243205060702 0001
  2244205070307 0403

     CARD THREE, TULANE, FOLLOWS!

  20113079
  20133050
  20413 31
  20433039
  20443 77
  20513105
  20523077
  20533092
  20543110
  20613   20242822
```

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20623   30463437
2063307736312926
2064310739443851
20713095          262325232718
20733097
20743076
20913076
20923109
20933098
20943099
21113097
21123099
21133094
21143109
21313090
21333092
21343070
21413 33
21423099
21433 3940373841
21443 3526332924
21513111          41474247343755
21523101          24232511342318
2153305226273639
2154307329363624
21713090                          121112
21733091                          192226
21743                             202124
21813072
21823097
21833099
21843091
22013076
22023078
22033095
22043097
22113070
22123099
22133096
22143092
22223093
22313077          171117220000
22333             262235003600
22343             30402555
22413078
22433095
22443098
2251307338312938
2252309532434134
2253307814283624
2254309238424738
26533053
26543105
```

APPENDIX E.

MEANS, STANDARD DEVIATIONS, AND PROBABILITY FOR DALLAS SUBJECTS

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T-TESTS
                                                                                                   VERSION OF 9/1/68

T-TESTS, INDEX=GROUP 1, DALLAS

      NUMBER OF ENTITIES IN DALLAS  =   38

      NUMBER OF ENTITIES IN  GROUP 2=   38

      NUMBER OF VARIABLES =   44

      INPUT ON DEVICE NUMBER =     8
      (0=CARD INPUT)

 DATA FORMAT  (A4,T0,44I1)


NOTE THAT AN F-RATIO OF 999.99 INDICATES THAT ALL SCORES FOR THAT VARIABLE IN GROUP 1 (FOR UNRELATED DATA) OR OBSERVATION 1 (FOR
RELATED DATA) WERE EQUAL TO ZERO.
LIKEWISE, AN F-RATIO OF -999.99 INDICATES THAT ALL SCORES FOR THAT VARIABLE IN GROUP 2 (FOR UNRELATED DATA) OR
OBSERVATION 2 (FOR RELATED DATA) WERE EQUAL TO ZERO.

VARIABLE            DALLAS                         GROUP 2              T-TEST    DF    F-RATIO      PROB FOR T      PROB FOR F
                  MEAN     STD.DEV.            MEAN     STD.DEV.
  TR 1          7.02632     .99965           7.23684     .97077        -1,28    37      1.06          .2077           .4298
 TR 2           6.36842     .63336           6.47368     .68722         -,81    37      1.18          .4269           .3107
 TR 3           7.42105     .79293           7.18421     .86541         1,71    37      1.19          .0914           .2984
 TR4            6.26316     .55431           6.28947     .61107         -,23    37      1.22          .8167           .2778
 TR 5           6.44737     .60168           6.34210     .53405          ,94    37      1.27          .3550           .2357
 TR 6           6.42105     .64228           6.36842     .67468          ,42    37      1.10          .6788           .3830
 TR 7           7.42105     .75808           7.44737     .76042         -,17    37      1.01          .8587           .4926
 TR 8           6.71053     .95600           6.21053     .62203         3,58    37      2.36          .0013           .0055
  TR 9          6.42105     .82631           6.21053     .62203         1,43    37      1.76          .1566           .0439
  TR 10         6.42105     .82631           6.26316     .68514          ,90    37      1.45          .3761           .1297
  TR 11         7.52632     .86171           7.05263    1.01202         2,69    37      1.38          .0102           .1663
  TR 12         6.36842     .78572           6.05263     .32444         2,23    37      5,86          .0301           .0000
  TR 13         7.07895     .99679           6.31579     .73908         4,01    37      1.82          .0005           .0362
  TR 14         6.57895     .88932           6.26316     .68514         1,92    37      1.68          .0601           .0584
  TR 15         6.60526     .91650           6.36842     .78572         1,20    37      1.36          .2365           .1767
  TR 16         7.18421     .98242           6.52632     .89252         3,87    37      1.21          .0007           .2808
  TR 17         6.21053     .62203           6.10526     .45259          ,81    37      1.89          .4269           .0282
  TR 18         7.31579     .96157           6.44737     .82846         4,68    37      1.35          .0001           .1845
  TR 19         6.86842     .99107           6.63158     .94214         1,42    37      1.11          .1593           .3797
  TR 20         6.36842     .78572           6.15789     .54656         1,43    37      2,07          .1566           .0150
  TR 21         7.44737     .89132           6.68421     .96157         3,61    37      1.16          .0012           .3231
  TR 22         6.60526     .91650           6.23684     .63392         2,06    37      2.09          .0436           .0138
  TR 23         6.23684     .58975           6.21053     .52802          ,22    37      1,25          .8250           .2521
  TR 24         6.15789     .54656           6.13158     .47483          ,27    37      1.32          .7819           .1981
 TR 25          6.15789     .43659           6.18421     .51230         -,24    37      1.38          .8070           .1676
 TR 26          6.81579     .98242           6.47368     .86171         2,12    37      1.30          .0383           .2144
 TR 27          6.36842     .71362           6.15789     .54656         1,54    37      1.70          .1287           .0544
 TR 28          6.57895     .91921           6.26316     .68514         1,53    37      1.80          .1319           .0387
 TR 29          7.42105     .88932           7.57895     .82631        -1,03    37      1.16          .3106           .3283
 TR 30          6.65789     .93798           6.26316     .68514         2,37    37      1.87          .0219           .0297
TR 31       6.84210   1.00071       6.42105    .82631       2.46    37     1.47      .0178       .1245
TR 32       6.31579    .70156       6.10526    .38831       1.67    37     3.26      .0995       .0004
TR 33       6.73684    .94966       6.36842    .78572       2.28    37     1.46      .0271       .1270
TR 34       7.47368    .89252       6.73684    .97771       4.65    37     1.20      .0001       .2907
TR 35       6.36842    .78572       6.28947    .69391        .46    37     1.28      .6503       .2266
TR 36       6.44737    .72400       6.26316    .55431       1.48    37     1.71      .1431       .0542
TR 37       6.47368    .82975       6.39474    .75479        .68    37     1.21      .5055       .2835
TR 38       6.10526    .45259       6.07895    .35880        .27    37     1.59      .7819       .0812
TR 39       6.57895    .91921       6.26316    .68514       1.64    37     1.80      .1060       .0387
TR 40       6.63158    .94214       6.26316    .68514       1.74    37     1.89      .0861       .0280
TR 41       6.10526    .45259       6.26316    .68514      -1.14    37     2.29      .2614       .0069
TR 42       6.05263    .32444       6.00000    .00000       1.00    37    99.99      .3252      9.9999
TR 43       6.05263    .32444       6.15789    .54656      -1.00    37     2.84      .3252       .0013
TR 44       6.15789    .54656       6.15789    .54656        .00    37     1.00     1.0000       .5000
*STOP* 0
```

6

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T-TESTS                                                                                                   VERSION OF 9/1/68

T-TESTS, INDEX=GROUP 1, DALLAS

       NUMBER OF ENTITIES IN DALLAS  =    29

       NUMBER OF ENTITIES IN  GROUP 2=    29

       NUMBER OF VARIABLES =     7

       INPUT ON DEVICE NUMBER =     0
       (0=CARD INPUT)

 DATA FORMAT  (A5,7F2.0)


NOTE THAT AN F-RATIO OF 999.99 INDICATES THAT ALL SCORES FOR THAT VARIABLE IN GROUP 1 (FOR UNRELATED DATA) OR OBSERVATION 1 (FOR
RELATED DATA) WERE EQUAL TO ZERO.
LIKEWISE, AN F-RATIO OF -999.99 INDICATES THAT ALL SCORES FOR THAT VARIABLE IN GROUP 2 (FOR UNRELATED DATA) OR
OBSERVATION 2 (FOR RELATED DATA) WERE EQUAL TO ZERO.


VARIABLE            DALLAS                        GROUP 2              T-TEST    DF     F-RATIO        PROB FOR T        PROB FOR F
                 MEAN     STD.DEV.             MEAN     STD.DEV.
WORD MNG       7.17241    2.77835            8.10345    2.91970         -1.89    28       1.10           .0665             .3973
LISTNING       9.75862    3.07821           10.68965    2.62003         -1.34    28       1.38           .1393             .1994
MATCHING       6.62069    4.36229            8.10345    3.81112         -1.89    28       1.31           .0664             .2395
ALPHABET       9.31034    5.85003           11.37931    5.27402         -2.48    28       1.23           .0183             .2913
NUMBERS       11.03448    6.20186           12.24138    5.53983         -1.17    28       1.25           .2503             .2768
COPYING        4.06896    2.91463            5.82759    3.56640         -2.27    28       1.50           .0293             .1458
TOTAL         48.20689   21.11601           56.68965   19.29308         -2.69    28       1.20           .0114             .3177
*STOP* 0
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T-TESTS
                                                                                     VERSION OF 9/1/63

DALLAS ACHIEVEMENTS

      NUMBER OF ENTITIES IN INDEX    =   17

      NUMBER OF ENTITIES IN CONTRL   =   17

      NUMBER OF VARIABLES =   10

      INPUT ON DEVICE NUMBER =     0
      (0=CARD INPUT)

 DATA FORMAT  (A4,T22,10F2.0)


NOTE THAT AN F-RATIO OF 999.99 INDICATES THAT ALL SCORES FOR THAT VARIABLE IN GROUP 1 (FOR UNRELATED DATA) OR OBSERVATION 1 (FOR
RELATED DATA) WERE EQUAL TO ZERO.
LIKEWISE, AN F-RATIO OF -999.99 INDICATES THAT ALL SCORES FOR THAT VARIABLE IN GROUP 2 (FOR UNRELATED DATA) OR
OBSERVATION 2 (FOR RELATED DATA) WERE EQUAL TO ZERO.


VARIABLE            INDEX                       CONTRL             T-TEST    DF     F-RATIO       PROB FOR T       PROB FOR F
                  MEAN    STD.DEV.            MEAN    STD.DEV.
 READ VOC      16.82352   5.51143          19.29411   7.26950      -2.20     16      1.25          .0406            .3321
 READ COM      17.29411   5.72020          17.88234   7.20141       -.70     16      1.58          .5025            .1832
 TOT READ      17.00000   5.54750          19.05882   7.17174      -2.19     16      1.20          .0418            .3598
 ARI REAS      15.82353   5.91655          18.17647   5.34130      -2.74     16      1.23          .0138            .3428
 ARI FUND      15.88235   5.19209          17.35294   6.64211      -1.03     16      1.52          .3202            .2051
 TOT ARTH      15.82353   5.74755          17.35294   5.64515      -1.76     16      1.43          .0950            .2414
 MECH ENG      16.58823   5.98250          19.70587   6.13153      -2.39     16      1.30          .0281            .3041
 SPELLING      14.47059  12.06295          18.47059  10.75941      -1.95     16      1.26          .0667            .3259
 TOT LANG      17.82352   5.33094          19.70587   6.65926      -1.79     16      1.57          .0888            .1897
 AVG GRAD      16.76469   5.90591          18.64705   6.16382      -2.79     16      1.26          .0126            .3269
 *STOP* 0
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T-TESTS                                                                                                    VERSION OF 9/1/68

DALLAS, ACHIEVEMENT TESTS AND IQ

        NUMBER OF ENTITIES IN INDEX   =   19

        NUMBER OF ENTITIES IN CONTROL =   19

        NUMBER OF VARIABLES =    7

        INPUT ON DEVICE NUMBER =     0
        (0=CARD INPUT)

 DATA FORMAT  (A4,T47,4F2.0,2F4.0,T69,F3.0)


NOTE THAT AN F-RATIO OF 999.99 INDICATES THAT ALL SCORES FOR THAT VARIABLE IN GROUP 1 (FOR UNRELATED DATA) OR OBSERVATION 1 (FOR
RELATED DATA) WERE EQUAL TO ZERO.
LIKEWISE, AN F-RATIO OF -999.99 INDICATES THAT ALL SCORES FOR THAT VARIABLE IN GROUP 2 (FOR UNRELATED DATA) OR
OBSERVATION 2 (FOR RELATED DATA) WERE EQUAL TO ZERO.


 VARIABLE             INDEX                           CONTROL                T-TEST   DF     F-RATIO        PROB FOR T         PROB FOR F
                  MEAN      STD.DEV.             MEAN      STD.DEV.
 LOG READS     15.94736     6.62395          23.73684     5.74305         -3.56     18       1.33            .0025              .2741
 NUM READS     10.53158     2.71233          13.47368     3.07964         -3.39     18       1.29            .0035              .2973
 VERB COM      13.15789     3.20179          13.52632     4.53834          -.41     18       2.01            .6869              .0741
 MEMORY         5.84210     3.53151           7.63158     3.56231         -2.01     18       1.02            .0570              .4858
 LAN R/IQ      76.68420    14.91136          85.57893    12.65062         -2.44     18       1.39            .0242              .2459
 NON_R/IQ      70.57893    17.60774          92.10526    12.84050         -4.21     18       1.89            .0008              .0927
 TOTAL/IQ      75.68420    15.21352          97.68420    13.22061         -3.99     18       1.32            .0011              .2783
 *STOP* 0
```

```
T-TESTS                                                                                              VERSION OF 9/1/68

DALLAS: ACHIEVEMENT TESTS

      NUMBER OF ENTITIES IN INDEX    =    4

      NUMBER OF ENTITIES IN CONTROL  =    4

      NUMBER OF VARIABLES  =    5

      INPUT ON DEVICE NUMBER  =     0
      (0=CARD INPUT)

 DATA FORMAT   (A4,T5F,5F2.0)


NOTE THAT AN F-RATIO OF 999.99 INDICATES THAT ALL SCORES FOR THAT VARIABLE IN GROUP 1 (FOR UNRELATED DATA) OR OBSERVATION 1 (FOR
RELATED DATA) WERE EQUAL TO ZERO.
LIKEWISE, AN F-RATIO OF -999.99 INDICATES THAT ALL SCORES FOR THAT VARIABLE IN GROUP 2 (FOR UNRELATED DATA) OR
OBSERVATION 2 (FOR RELATED DATA) WERE EQUAL TO ZERO.


VARIABLE          INDEX                            CONTROL                 T-TEST    DF     F-RATIO        PROB FOR T        PROB FOR F
               MEAN      STD.DEV.              MEAN      STD.DEV.
READ TOT     17.75000    2.59398             28.50000    4.43471          -3.01      3        1.52            .0556             .3684
LAN TOTL     18.25000    5.43906             31.75000    9.17678          -2.96      3        2.85            .0580             .2062
ARTH TOT     19.25000    6.65207             30.75000    3.59398          -2.30      3        3.43            .1039             .1696
BATT TOT     18.25000    4.11299             30.00000    2.44949          -4.10      3        2.82            .0245             .2084
STUDY SK     17.75000    7.22542             27.50000   11.56143          -1.72      3        2.56            .1841             .2300
*STOP* 0
```

APPENDIX F.

MEANS, STANDARD DEVIATIONS, AND PROBABILITY FOR NEW ORLEANS SUBJECTS

```
T-TESTS, INDEX=GROUP 1, TULANE      1:3

      NUMBER OF ENTITIES IN TULANE  =   19

      NUMBER OF ENTITIES IN  GROUP 2=   19

      NUMBER OF VARIABLES =   44

      INPUT ON DEVICE NUMBER =    8
      (0=CARD INPUT)

 DATA FORMAT  (A4,T0,44I1)


NOTE THAT AN F-RATIO OF 999.99 INDICATES THAT ALL SCORES FOR THAT VARIABLE IN GROUP 1 (FOR UNRELATED DATA) OR OBSERVATION 1 (FOR
RELATED DATA) WERE EQUAL TO ZERO.
LIKEWISE, AN F-RATIO OF -999.99 INDICATES THAT ALL SCORES FOR THAT VARIABLE IN GROUP 2 (FOR UNRELATED DATA) OR
OBSERVATION 2 (FOR RELATED DATA) WERE EQUAL TO ZERO.


VARIABLE              TULANE                           GROUP 2          T-TEST   DF     F-RATIO       PROB FOR T       PROB FOR F
                   MEAN     STD.DEV.             MEAN     STD.DEV.
  TR 1           7.05263   1.02598             6.78947    .97633          .77    18       1.10          .4557            .4178
 TR I 2          6.36842    .59727             6.42105    .60698         -.37    18       1.03          .7166            .4733
 TR 3            7.26316    .80569             7.15789    .68825          .42    18       1.37          .6840            .2549
 TR4             6.31579    .58240             6.42105    .50726         -.70    18       1.32          .5008            .2815
 TR 5            6.47368    .61178             6.57895    .50726         -.57    18       1.45          .5838            .2170
 TR 6            6.63158    .76089             6.63158    .68399          .00    18       1.24         1.0000            .3276
 TR 7            7.42105    .76853             7.08263    .77987         1.59    18       1.03          .1266            .4757
 TR 8            6.26316    .65338             6.36842    .76089         -.42    18       1.36          .6840            .2619
  TR 9           6.26316    .56196             6.31579    .74928         -.25    18       1.78          .7992            .1160
  TR 10          6.63158    .89508             6.84210   1.01452         -.61    18       1.28          .5579            .2999
  TR 11          7.15789   1.01452             7.78947    .63061        -2.05    18       2.59          .0525            .0253
  TR 12          6.26316    .65338             6.42105    .83771         -.64    18       1.64          .5338            .1505
  TR 13          6.78947    .97633             6.63158    .95514          .48    18       1.04          .6395            .4636
  TR 14          6.68421    .94591             6.47368    .84120          .85    18       1.26          .4130            .3115
  TR 15          6.57895    .90159             6.57895    .90159          .00    18       1.00         1.0000            .5000
  TR 16          6.94737   1.02598             6.84210   1.01452          .37    18       1.02          .7166            .4814
  TR 17          6.26316    .65338             6.73684    .99119        -1.53    18       2.30          .1400            .0426
  TR 18          6.78947    .97633             6.84210   1.01452         -.24    18       1.08          .8104            .4363
  TR 19          7.21053    .97633             7.36842    .95514         -.55    18       1.04          .5972            .4636
  TR 20          6.36842    .76089             6.21053    .63061          .64    18       1.46          .5338            .2164
  TR 21          6.68421    .94591             7.05263   1.02598        -1.33    18       1.18          .1992            .3667
  TR 22          6.47368    .84120             6.42105    .83771          .19    18       1.01          .8417            .4931
  TR 23          6.15789    .50146             6.31579    .74928         -.72    18       2.23          .4882            .0485
  TR 24          6.47368    .84120             6.42105    .83771          .19    18       1.01          .8417            .4931
 TR 25           6.31579    .58240             6.31579    .58240          .00    18       1.00         1.0000            .5000
 TR 26           6.73684    .93346             6.57895    .90159          .55    18       1.07          .5972            .4424
 TR 27           6.36842    .68399             6.10526    .31531         1.56    18       4.71          .1320            .0013
 TR 28           6.68421    .94591             6.73684    .99119         -.19    18       1.10          .8417            .4225
 TR 29           7.57895    .83771             7.73684    .65338         -.59    18       1.64          .5690            .1505
 TR 30           6.63158    .89508             6.94737    .97032        -1.00    18       1.18          .3322            .3676
 TR 31           6.57895    .90159             6.52632    .90483          .17    18       1.01          .8614            .4941
 TR 32           6.47368    .77234             6.57895    .90159         -.40    18       1.36          .6962            .2587
TR 33      6.94737    .97032          6.36842     .76089         2.80   18      1.63          .0115          .1557
TR 34      7.52632    .84120          6.84210    1.01452         2.23   18      1.45          .0365          .2170
TR 35      6.73684    .99119          6.31579     .74928         1.71   18      1.75          .1004          .1224
TR 36      6.57895    .83771          6.36842     .59727         1.07   18      1.97          .2977          .0804
TR 37      6.42105    .69248          6.21053     .53531         1.17   18      1.67          .2581          .1421
TR 38      6.10526    .45884          6.10526     .45884          .00   18      1.00         1.0000          .5000
TR 39      6.42105    .83771          6.00000     .00000         2.19   18     99.99          .0398         9.9999
TR 40      6.36842    .76089          6.10526     .45884         1.76   18      2.75          .0929          .0190
TR 41      6.05263    .22943          6.05263     .22943          .00   18      1.00         1.0000          .5000
TR 42      6.36842    .68399          6.10526     .31531         1.76   18      4.71          .0929          .0013
TR 43      6.10526    .45884          6.00000     .00000         1.00   18     99.99          .3322         9.9999
TR 44      6.21053    .53531          6.05263     .22943         1.37   18      3.44          .1842          .0006
*STOP* 0
```

APPENDIX G.

RESULTS OF MULTIPLE REGRESSION ANALYSES FOR NEW ORLEANS SUBJECTS

```
MULTIPLE REGRESSION ANALYSIS (REGRAN) WITH XTRAN                                                              VERSION OF 10/70

TULANE, TEACHERS' RATINGS BY GROUPS, CONTROLLED

INPUT PARAMETERS
================

          NUMBER OF VARIABLES                      18

          NUMBER OF SUBJECTS                       70

          NUMBER OF  MODEL CONTROL CARDS            7

          NUMBER OF F-TEST CONTROL CARDS           25

          INPUT ON DEVICE NO,                       8
          (0=CARD INPUT)

          OUTPUT ON DEVICE NO,                      6

          DATA FORMAT  (//A4,9X,I3,6X,I3,3X,2I3,3X,5I3,3X,I3/4X,8I3)


INTERCORRELATION ANALYSIS
=========================

          VARIABLE             MEANS             STAND. DEV,

           SEX                 1.486               .528

           RACE                1.914               .280

           TR SUM            147.600             27.206

           AGE               120.571             13.133

          ONES                  .271               .445

          TWOS                  .171               .377

          THREES                .286               .452

           FOURS                .271               .445

 1s, 3s   ~~2S,4S~~              .557               .497

          ONES<6                .071               .258

          ONES 6-2              .100               .300

          ONES>24               .100               .300

          3S<6                  .100               .300

          3S 6-24               .057               .232

          3S>24                 .129               .335

          1,3<6                 .171               .377
```

```
1,3 6-24      .157      .364
1,3>24        .229      .420
```

CORRELATION MATRIX

```
                   1       2       3       4       5       6       7       8       9      10      11      12      13      14      15
        SEX      1,000
        RACE     -,105   1,000
        TR SJM    ,006   -,061   1,000
        AGE      -,178   -,068    ,071   1,000
       ONES      -,014   -,137   -,247    ,008   1.000
       TWOS       ,084    ,004    ,185    ,104   -.278   1.000
       THREES    -,043    ,081   -,170   -,073   -,386   -,288   1,000
        FOURS    -,014    ,072    .263   -,022   -,373   -,278   -,386   1,000
 1,3s ~~2S/4S~~  -,051   -,068   -,376   -,060    .544   -,510    ,564   -,685   1.000
       ONES<5     ,060   -,113   -,059   -,130    .454   -,126   -,175   -,169    .247   1.000
       ONES 5-2  -,036   -,068   -,081   -,181    .546   -,152   -,211   -,203    ,297   -,092   1.000
       ONES>24   -,036   -,068   -,235    ,305    .546   -,152   -,211   -,203    ,297   -,092   -,111   1.000
       3S<6       ,054    ,102   -,140   -,334   -,203   -,152    ,527   -,203    ,297   -,092   -,111   -,111   1.000
       3S 6-24   -,110    ,075    ,071   -,086   -,150   -,112    ,389   -,150    ,219   -,068   -,082   -,082   -,082   1.000
       3S>24     -,030   -,035   -,153    ,260   -,234   -,175    ,607   -,234    ,342   -,107   -,128   -,128   -,128   -,095   1.000
       1,3<6      ,084    ,004   -,152   -,355    .149   -,207    ,300   -,278    ,406    ,610   -,152   -,152    ,733   -,112   -.175
       1,3 6-24  -,100   -,008   -,021   -,204    .354   -,196    ,074   -,264    ,385   -,120    ,772   -,144   -,144    ,570   -.166
       1,3>24    -,050   -,076   -,290    ,424    .203   -,248    ,334   -,332    ,485   -,151   -,181    ,612   -,181   -,134    .706


                  16      17      18
      1,3<6      1,000
      1,3 6-24   -,196   1,000
      1,3>24     -,248   -,235   1,000


      MODEL  1
      ========

         CRITERION:  VARIABLE       3
```

```
P    CTO    ARI     1    , 4    ,     , 1    ,

    R =  ,4520, R-SQUARED =  ,2043 AFTER 25 ITERATIONS
    UNBIASED (SHRUNKEN) ESTIMATE OF POPULATION R-SQUARED =  ,0849

        VARIABLE     BETA-WT          B-WT
         SEX           ,0157                  ,8094
         RACE         -,0953               -9,2612
         AGE           ,1504                  ,3116
        TWOS          -,0268               -1,9354
        ONES<6        -,1620              -17,1142
        ONES 6-2      -,1856              -16,8327
        ONES>24       -,3910              -35,4593
        3S<6          -,2039              -18,4898
        3S 6-24       -,0150               -1,7558
        3S>24         -,3189              -25,9160
    REGR. CONSTANT =             138,6239


MODEL  2
========
    CRITERION:  VARIABLE      3
    PREDICTORS: VARIABLES  1-  2,  4-  6, 10- 15,

    R =  ,4513, R-SQUARED =  ,2037 AFTER 22 ITERATIONS
    UNBIASED (SHRUNKEN) ESTIMATE OF POPULATION R-SQUARED =  ,0993

        VARIABLE     BETA-WT          B-WT
         SEX           ,0135                  ,6985
         RACE         -,0951               -9,2422
         AGE           ,1442                  ,2987
        ONES<6        -,1554              -16,4182
        ONES 6-2      -,1781              -16,1500
        ONES>24       -,3816              -34,6029
        3S<6          -,1998              -18,1221
        3S 6-24       -,0079                -,9218
        3S>24         -,3072              -24,9691
    REGR. CONSTANT =             139,5616
```

```
MODEL  3
********

       CRITERION:  VARIABLE        3

       PREDICTORS: VARIABLES  1-  2,  4-  4, 16- 18,

       R =  .4306, R-SQUARED =  .1854 AFTER 14 ITERATIONS

       UNBIASED (SHRUNKEN) ESTIMATE OF POPULATION R-SQUARED =  .1218

         VARIABLE      BETA-WT           B-WT

          SEX              .0041                  ,2096

          RACE            -.0860                -8,3625

          AGE              .1369                  ,2836

         1,3<6            -.2440               -17,6145

         1,3 6-24         -.1471               -10,9936

         1,3>24           -.4499               -29,1465

       REGR. CONSTANT =              140.3070


MODEL  4
********

       CRITERION:  VARIABLE        3

       PREDICTORS: VARIABLES  1-  2,  4-  4,  5-  7,

       R =  .3939, R-SQUARED =  .1551 AFTER  7 ITERATIONS

       UNBIASED (SHRUNKEN) ESTIMATE OF POPULATION R-SQUARED =  .0891

         VARIABLE      BETA-WT           B-WT

          SEX             -.0138                 -.7108

          RACE            -.0932                -9,0559

          AGE              .0440                  .0712

         ONES             -.3892               -23,8095

         TWOS             -.0176                -1.2729

         THREES           -.3150               -18,9701
```

```
REGR. CONSTANT =              167.1003

MODEL  5
********

    CRITERION: VARIABLE       3

    PREDICTORS: VARIABLES  1-  2,  4-  4,  5-  5,  7-  7,

    R =  .3936, R-SQUARED =  .1549 AFTER  6 ITERATIONS

    UNBIASED (SHRUNKEN) ESTIMATE OF POPULATION R-SQUARED =  .1029

       VARIABLE     BETA-WT          B-WT

        SEX           -.0154                -.7944

        RACE          -.0954               -9.2716

        AGE            .0451                .0933

       ONES           -.3604              -23.2733

       THREES         -.3062              -18.4411

    REGR. CONSTANT =               166.8608


MODEL  6
********

    CRITERION: VARIABLE       3

    PREDICTORS: VARIABLES  1-  2,  4-  4,  9-  9,

    R =  .3881, R-SQUARED =  .1506 AFTER  4 ITERATIONS

    UNBIASED (SHRUNKEN) ESTIMATE OF POPULATION R-SQUARED =  .1120

       VARIABLE     BETA-WT          B-WT

        SEX           -.0154                -.7935

        RACE          -.0860               -8.3560

        AGE            .0424                .0878

 I5, S5  ~~25/43~~    -.3792              -20.7708

    REGR. CONSTANT =               165.7593


MODEL  7
```

```
CRITERION: VARIABLE       3
PREDICTORS: VARIABLES  1-  2,  4-  4,

R =  .0910, R-SQUARED =  .0083 AFTER  3 ITERATIONS
UNBIASED (SHRUNKEN) ESTIMATE OF POPULATION R-SQUARED = -.0213

     VARIABLE      BETA-WT          B-WT
      SEX              .0117                    .6011
      RACE            -.0567                  -5.5064
      AGE              .0675                    .1399
REGR. CONSTANT =                 140.3855
```